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OIL WORLD
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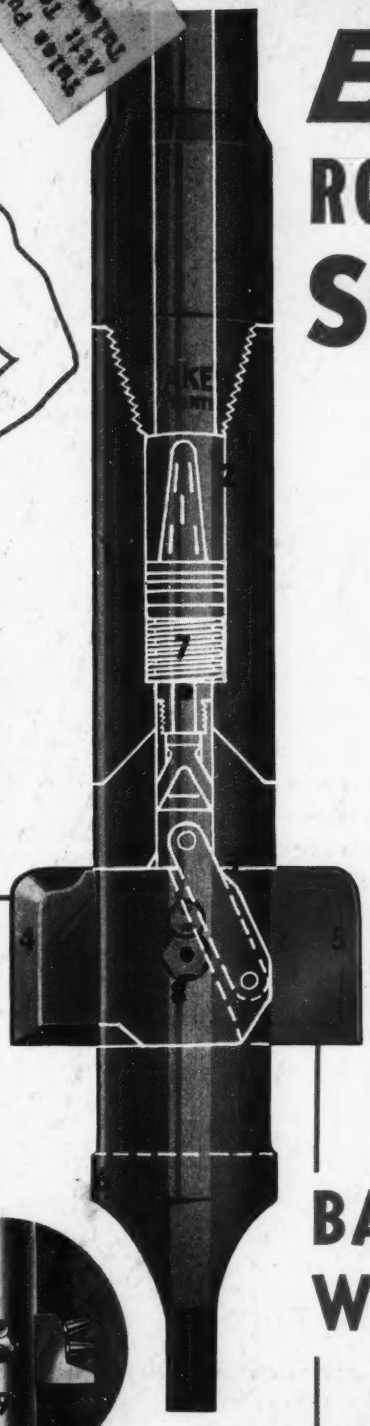

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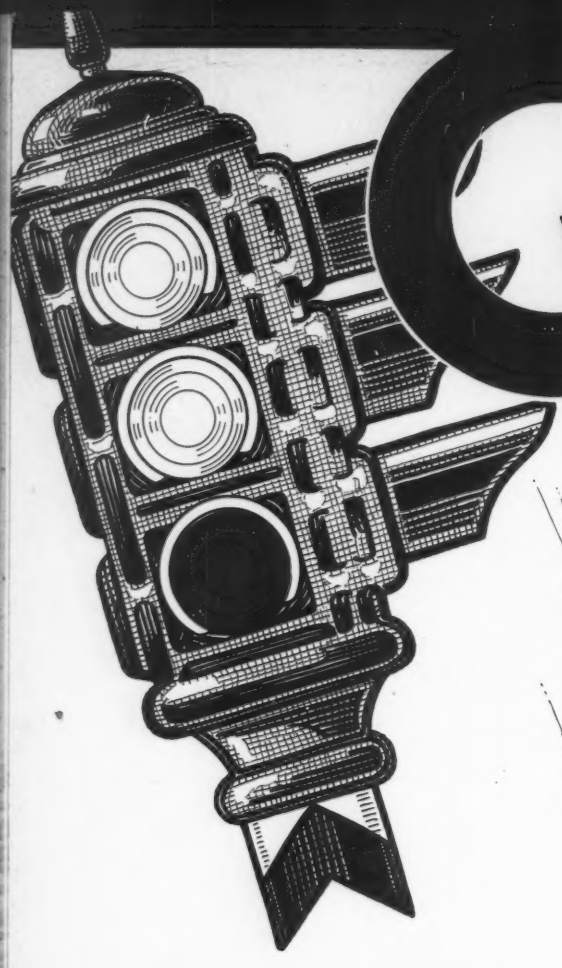

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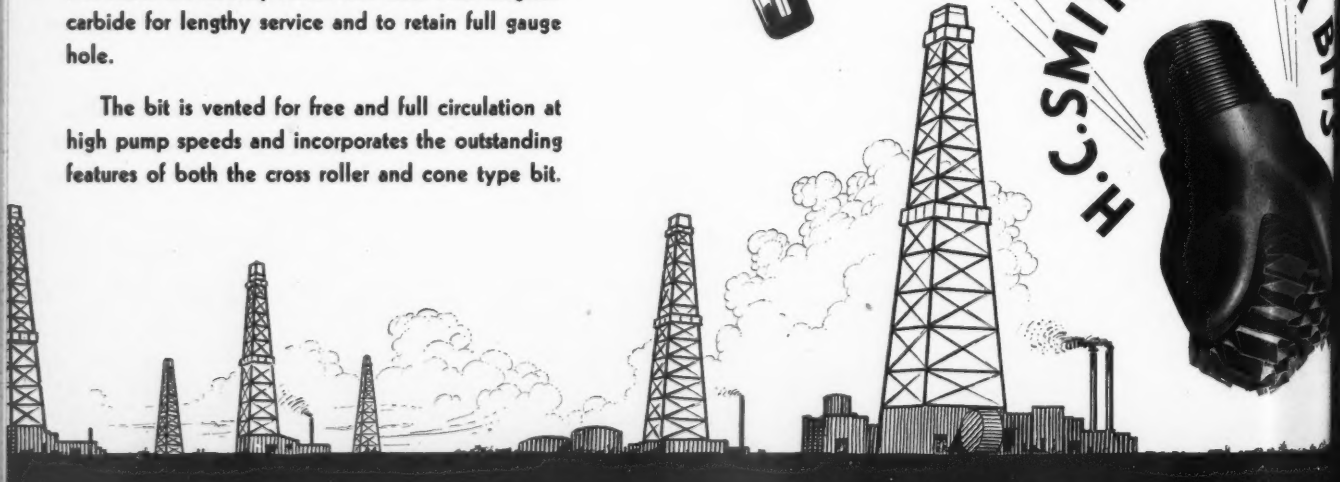

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OIL WORLD
and Petroleum Industry

THE AUTHORITY ON THE CALIFORNIA OIL INDUSTRY

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Important Oil Field Discoveries in all Areas

Marked 1938 California Activities

By V. H. Wilhelm
Member of the A. I. M. E.
Presented at the A. I. M. E. National Convention February, 1939.

In contrast with the previous year's activity, the California Oil Industry for 1938 showed a decrease in drilling, market demand, and in discovery of new oil reserves, although there was an increase in oil production. Although additions to reserves from new fields and extensions were less than withdrawals during the year, reappraisals of discoveries in 1937 added to new discoveries during 1938, amounted to over 300,000,000 barrels.

Throughout the year the storage situation became progressively more acute, due principally to less Pacific Foreign demand and increased potential from drilling the newly discovered fields and pools.

California storage increased approximately 32,000,000 barrels during 1938, most of which (approximately 18,000,000 barrels) was heavy crude and residuum. The market demand for the year was around 600,000 barrels per day.

Due to the trend toward diesel power for heavy transportation, the non-gasoline bearing crudes are fast becoming a drug on the market.

New discoveries were instrumental in increasing the potential production of the State from 1,076,000 barrels per day in January to an all time high of 1,420,000 barrels per day at the close of the year, although the indicated reserves of these new discoveries were not equal to the early withdrawal of 249,000,000 barrels. As of the end of 1938, the State was voluntarily curtailed about 58%.

As a result of prospecting during the year, six new fields were discovered, three fields were extended, and deeper zones were located in five of the older fields.

SAN JOAQUIN VALLEY

The San Joaquin Valley contributed four new fields, two of which, Coles Levee and Wasco, were the result of applied Geophysics.

East Coalinga: The Avenal (Eocene) was discovered on the southeast plunging nose of the East Coalinga anticline by the Petroleum Securities Oil Company in its Gatchell No. 2 well, which was completed flowing at the rate of 5,184 B/D 32° gravity oil from a depth of 6,892 feet. Production is coming from 90 feet of very permeable sand. Later developments in the area indicated a maximum thickness of 500 feet of sand. Shoreline deposits flanking the East Coalinga anticline are the reservoir beds for this accumulation and do not extend

V. H. Wilhelm

under the old proven area. Although the gas/oil ratio averages but 650 cubic feet per barrel of oil, the wells in this new field are capable of flowing at very high rates under hydrostatic pressure. While it is difficult to predict the ultimate productive area of a shoreline field, present development indicates that this is by far the most important discovery of the year.

Coles Levee: This field, situated about 3½ miles southeast of Elk Hills in Section 10-31-25, was discovered by the Ohio Oil Company when it completed its F-1 well from a depth of 8965 feet for 885 B/D of 44° gravity oil from 130 feet of sand (net) in the Stevens (Monterey) formation.

Richfield Western: The Richfield Western field, situated about three miles northwest of the Ohio Oil Company's Coles Levee (F-1) and one mile east of the proved area of Elk Hills in Section 32-30-25, was discovered by the Richfield Oil Corporation when it completed its Richfield Western No. 1 well from a depth of 8,677 feet, flowing 3,018 B/D of 44° gravity oil together with 18,000,000 cubic feet of gas from 195 feet of sand of the Stevens (Monterey) formation, which is productive in Ten Section field, approximately four miles northeast of this discovery.

It is the consensus of opinion that the Coles Levee, as well as the Richfield Western discoveries are located on the same structural feature which is supposed to be an overlap or shore line deposit along the flank of Elk Hills. If this is true, a field having a large areal extent has been discovered.

Wasco: Continental Oil Company discovered a new field in the Wasco district of Kern County when it brought in its K.C.L. No. 2-A, flowing 2,900 barrels of clean, 39.9° gravity oil and 720,000 cubic feet of gas per day from 83 feet of formation between 13,092 and 13,175 feet. The original depth of the well was 15,004 feet, which is the deepest drilled hole in the world. Production is coming from Miocene formations. The gas/oil ratio of the well is very low and due to the great depth, the flowing and gas lift stages will undoubtedly constitute the productive life of the well. At the present time, two producers and three dry holes have been drilled in the field. Its maximum proved limits is estimated at 250 acres. Wells will be spaced one to each forty acres. The discovery of the field is a technical triumph, but possibly an economic failure.

COASTAL DISTRICT

Las Flores: The Standard Oil Company made a new discovery adjacent to the old Cat Canyon field through the completion of its Las Flores Land No. 1 well for an initial of 800 bbls of 16° gravity oil from a depth of 6404 feet, production coming from broken shale. The structure on which the well was drilled is a narrow asymmetric fold and it is entirely possible that the Cat Canyon field will be extended to this structure. The oil contains about 6% sulphur and the well has been shut in since completion due to lack of a market for this type of crude.

Ventura Avenue: Continued drilling activity in the Ventura Avenue field has resulted in increasing the productive depth of this structure to below 11,000 feet, giving the field over 7,000 feet of Pliocene producing horizon, with added reserves of over 20,000,000 barrels.

LOS ANGELES BASIN

Aliso Canyon: In the San Fernando Valley, near the location of California's first oil discovery in the year 1876 at Pico Canyon, the Tide Water Associated Oil Company discovered the Aliso Canyon field. The prospect well, Porter No. 1, was drilled in Section 27-3-16 and was completed flowing 850 barrels of 23° gravity oil from a plugged depth of 5339 feet. The well was proposed to explore the Eocene sands of a well defined

anticline in the Monterey shale of Miocene age. It penetrated the flat dipping Santa Susana fault at 1,800 feet and found production in 500 feet of very porous sand in the Pico (Pliocene) formation. The extent or value of this discovery is as yet only a matter of conjecture.

Extensions of Fields

Montebello: The St. Helens Petroleum Co., Ltd., discovered two new zones (5th and 6th) in the lower Pliocene and upper Miocene in the west portion of the Montebello field. Its well, Monterey No. 20, was completed flowing 990 barrels of 36° gravity oil from a depth of 6353 feet. The Hathaway Oil Company discovered a 7th zone in its Dore No. 1 well at a depth of 7181 feet. Upon completion this well flowed 400 barrels of 35° gravity oil. Dore No. 1 well extended the Montebello field to the southwest. At the end of the year thirty wells were producing the newly discovered zones. Correlations with the zones developed in the East Montebello Extension indicates the possibility of several deeper zones being present in the west end of the field. The structural feature on the west end of Montebello is a plunging asymmetrical nose. Edge water lies very close to the axis of each zone. The axis of each deeper zone lies progressively further to the south. New reserves added to the Montebello field are estimated at 12,000,000 barrels.

Torrance: The most active field in the State during 1938 was the Torrance field where development extended its areal limit to the south and southeast through the discovery of the Del Amo zone, which lies approximately 1300 feet below the Upper or Main zone (3500-3800 ft.). The principal areas of development have been designated Lomita and Harbor City. Both areas are of a town lot nature and production decline has been so rapid that it is questionable if many of the operators will obtain the return of their investment, especially in the Lomita area. Completions have ranged between 100 to 600 barrels per day and in numerous instances 600 barrel wells have declined to 100 barrels within two months. The producing horizon is an overlap on the Torrance uplift and the permeability of the sand, which averages 70 feet in thickness, is very low. Similar to the history of the early development of the upper measures, this new drilling is not expected to be very profitable.

Wilmington: The Long Beach portion of this field was opened for drilling during the early part of the year and 200 wells were drilled. Very favorable results were obtained from Terminal zone wells producing from as much as 1000 feet of sand. With spacing of one well to the acre in the shore line area, the peak of production was 125,000 barrels a day in March. Drilling activity in the field is expected to continue during 1939, as there are as yet many undrilled locations. The Wilmington field is the only major oil field discovered in the Los Angeles Basin during the last eight years, and is considered to have reserves of approximately 200,000,000 barrels.

Rosecrans: Prospecting of Miocene formations in this field during 1938 revealed the existence of an additional reserve of approximately 20,000,000 barrels. Wells completed below the 7000 foot level have had initials ranging from 500 to 2,500 barrels of 30° gravity oil. Faulting is the controlling factor of this deeper accumulation.

Signal Hill: A deep test of the Signal Hill field was drilled during 1938 by the De Soto Oil Company in the prolific Lovelady Pool on the south flank of the structure. Initial production of the well was 250 barrels of 28° gravity oil, which is coming from between the depth of 9,760 feet and 10,157 feet. Considering its depth and small indicated potential, it is not a commercial well. The considerable sand thickness and unexpected gentle dips found in the Miocene at depth will probably be an incentive for further deep drilling during the coming year.

SUMMARY

Activity in the Oil Industry depends to a great extent, on general business conditions in the Country; also, drilling activity depends on the rate of new discoveries, as older fields tend to be fully drilled or are in a state of depletion where new drilling is uneconomical. During 1937, 40% of the drilling was in new fields discovered in 1936. In 1938 over 60% of the wells drilled were in fields and extensions discovered in 1936 and 1937.

The following comparative statement shows the important changes in various phases of the Industry:

	1937	1938	Increase or Decrease*
Wells Completed	1,156	987	168*
Market Demand-bbls.	239,000,000	218,000,000	21,000,000*
New Oil Reserves-bbls.	400,000,000	180,000,000	220,000,000*
Oil Production-bbls.	238,000,000	249,000,000	11,000,000

Activities in California Petroleum Industry

Year	Drilling Notices Filed	Drilling Wells Abandoned	Producers Completed	Increase or Decrease Over Previous Year	Initial Production On New Wells, Daily Average Per Well	Total
1929	1,256	314	910	.....	1,437	1,307,496
1930	918	254	755	—17%	775	584,521
1931	329	238	246	—67%	1,481	364,434
1932	279	191	184	—25%	852	156,823
1933	596	163	248	+35%	1,105	274,104
1934	631	247	449	+81%	1,190	534,508
1935	986	347	710	+37%	954	677,320
1936	1,102	320	786	+11%	471	370,227
1937	1,643	313	1,156	+47%	560	647,331
1938 (est.)	1,180	220	987	—14%	1,215	1,200,000

Emsco Founder Continues Active

E. M. Smith, founder and former president of the Emsco Derrick and Equipment Co., who recently disposed of his own and interests of others to the Youngstown Sheet and Tube Co. for more than two and one-half million dollars, announces that he will continue to be active in the oil equipment industry and will retain his many contacts with oil people throughout the world.

For the present, "E. M." will be located at E. M. Smith Co.'s branch office at 1121 Rothwell Street, Houston, Texas, where the company maintains warehouse facilities with complete stocks of the full line of Grizzly products for distribution to the Mid-Continent and Gulf Coast oil fields.

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2. General view of Axelson foundry floor.

3. Liner molds being made with aluminum patterns.

4. Pouring temperature-controlled metal into liner molds through strainers with skimmer attendants.

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Ordinary cast iron is all right for sash weights, but nothing ordinary is good enough for Axelson pump liners. The Axelson foundry was built because liners to Axelson quality could not be obtained elsewhere. Here Axelson liner production experiences 100 percent control, from molding sand through forty other materials to final precision finish and assembly.

Results: liner castings with close grain, fine texture, and inherent qualities that show up and deserve accurate machining, correct heat treatment and perfect polishing.

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Controversial Legislation Includes Control

Measure Backed by Labor Union

Several pieces of highly controversial oil legislation have been introduced into the present session of the California legislature. Among these the oil control bill introduced by Assemblyman Maurice Atkinson of Long Beach seems headed for the greatest fight in the legislature which reconvened March 6.

This bill, A. B. 1926, was introduced by Mr. Atkinson at the request of the Oil Workers Union, according to reliable reports, the reason for the Union's sponsorship being accounted for by the fact that the Union is said to consider that a control bill will result in greater stability of the industry, hence employment and wages will be less apt to be affected by a possible collapse.

General opinion in the industry is that the bill, if it is to be enacted into law, should be modified as to some of its provisions, it being felt that in many respects the bill is too strict.

The control bill is predicated upon conservation of natural resources and the prevention of waste. "Waste" is defined in three paragraphs of Section 2 as:

"(a) 'Underground waste' as those words are generally understood in the oil business, and in any event to embrace the inefficient, excessive, or improper, use or dissipation of the reservoir energy, including gas energy and water drive, of any pool, and the locating, spacing, drilling, equipping, operating, or producing of any well or wells in a manner to reduce or tend to reduce the total quantity of crude petroleum oil or natural gas ultimately recoverable from any pool.

"(b) 'Surface waste' as those words are generally understood in the oil business, and in any event to embrace the unnecessary or excessive surface loss or destruction without beneficial use, however caused, of natural gas, crude petroleum oil or any product thereof, but including the loss or destruction without beneficial use, resulting from evaporation, seepage, leakage, or fire, especially such loss or destruction incident to or resulting from the manner of spacing, equipping, operating, or producing, well or wells, or incident to or resulting from the use of inefficient storage or from the production of crude petroleum oil in excess of the reasonable market demand.

"(c) The production of crude petroleum oil in this State in excess of the reasonable market demand for such crude petroleum oil. Such excess production causes or results in waste which is prohibited by this act. The words 'reasonable market demand', as used herein, shall be construed to mean the demand for such crude petroleum oil for reasonable current requirements for current consumption and use within or outside the State, together with the demand for such amounts as are reasonably necessary for building up or maintaining reasonable storage reserves of crude petroleum oil or the products thereof, or both such crude petroleum oil and products."

A three man commission, consisting of the Governor (or a "practical oil man" as his representative), the Director of Finance, and the Director of Natural Resources is created to administer the bill. The commission is empowered to issue rules and regulations to effectuate the act, including the requiring of well spacing plans, unit or proration plans, and others.

To enforce the proration provisions of the act, the commission is given power to seize and sell "illegal" oil. "Illegal" oil is oil produced in excess of the allowable granted to any well, but when the commission seizes and sells it, it becomes legal for the purchaser. No provision is made to salvage the Gas Conservation Act, or the town lot drilling law.

Depletion Allowance

Three bills, each amending a different law now on the statute books, have been introduced to limit the percentage depletion allowance now in effect as to California income taxation. It will be remembered that attacks on this allowance frequently recur in the Federal government, but thus far have been successfully opposed by the oil industry and other natural resources industries.

The State bills, A.B. Nos. 2645, 2648, and 2655, amend the Personal Income Tax Act of 1935, the Bank and Corporation Franchise Tax Act, and the Corporation Income Tax Act of 1937, respectively. All have been referred to the Committee on Revenue and Taxation, and all would limit the depletion allowance of the oil industry to the basis of the particular property involved.

The effect of the enactment of these acts would be to materially reduce the present California depletion allowance. When a company has recovered the cost of an oil property by charging it to expense, then no further allowance for depletion deduction for California tax purposes will be granted with respect to that property. Oil companies would be entitled only to recover their investment on each specific property with no additional allowance against losses on nonproductive leases and dry holes.

Three severance tax bills, Assembly Bills Nos. 212, 2657, and 2732, have been introduced A. B. 2652 apparently being the one with Administration support. A. B. 212, introduced by Assemblyman Voigt early in the session, apparently is to be disregarded, especially since he is the author of A. B. 2732.

Aside from the tax rate, A. B. 2657 (Administration) and 2732 are identical.

Newly elected legislators in Los Angeles after oil tour.

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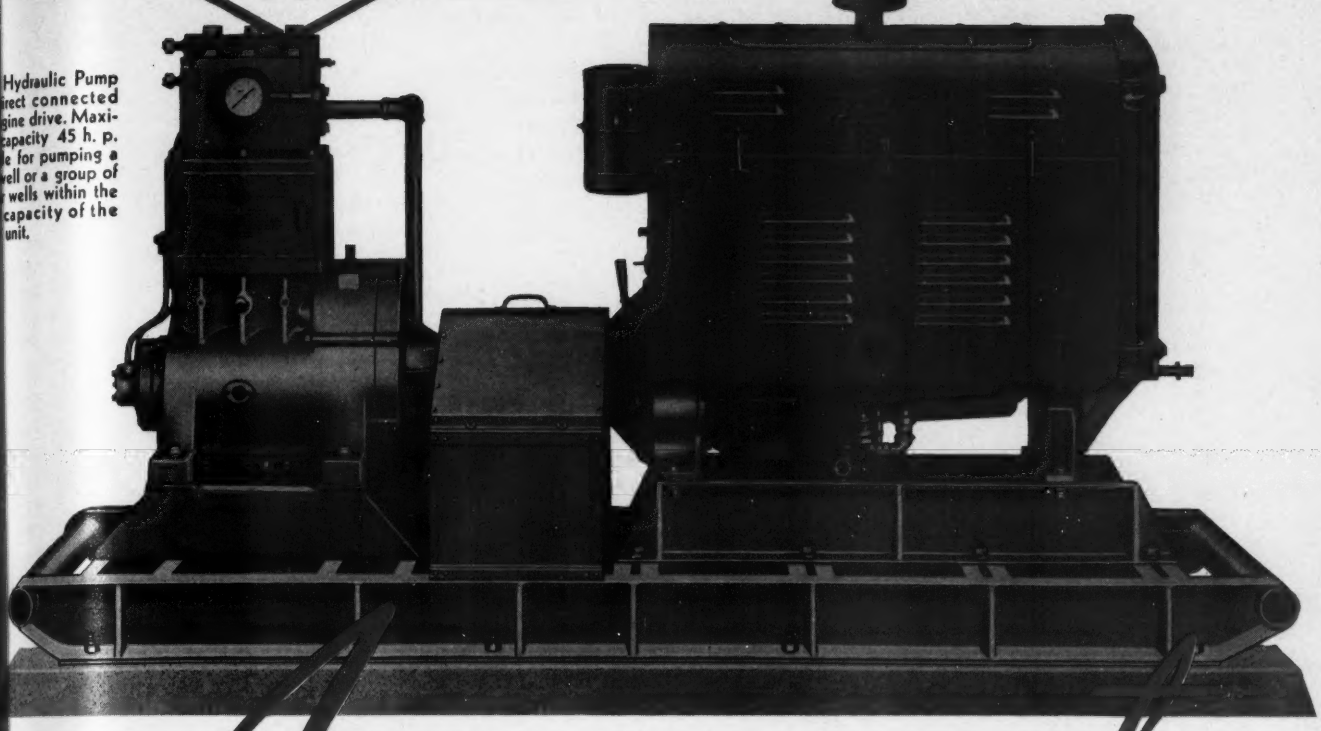

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* * * *

The Kobe Hydraulic Pump is a complete fluid-operated oil well pumping unit. All mechanical links such as sucker rods, walking beam, pitman, and counterbalance are replaced by a single stationary pipe to carry the hydraulic fluid. There are no moving parts on the derrick floor or in the well tubing, and oil well pumping is reduced to the ultimate in simplicity and high efficiency.

The Kobe method is ideally adapted to producing wells of any depth or size; either individually, or in groups from a central power unit. The direction of the hole has no effect on its operation; if tubing can be run into the hole at all, the Kobe Pump will produce with the same high efficiency as if the hole were straight. During many years of service in different fields under a wide range of conditions, no pumping problem has been encountered that cannot be handled efficiently and economically.

The overall efficiencies of the Kobe Pump from the prime mover input to fluid at the well head range from 60% to 75% . . . the highest yet attained in oil well pumping . . . instead of the customary 25% to 35%. Through these uniquely high overall efficiencies, the operating cost per barrel of fluid lifted is reduced to absolute minimum.

Despite the fact that the Kobe Pump will do everything that any other pumping equipment can do, and at less cost; that it will produce many types of wells entirely beyond the scope of any other unit; and that it completely eliminates all damage to casing and tubing; it costs no more to equip a well or group of wells with a Kobe Hydraulic pumping unit than with any mechanical unit of good quality.

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Taxes assessed by A. B. 2657, introduced by Assemblymen O'Donnell, Collins, and Atkinson, start at 1.4 cents per barrel on oil of less than 15° gravity, increasing to 2.7 cents per barrel on oil of 34° gravity and higher. Natural gas is taxed at 12/100 cents per m.c.f. and natural gasoline at the same rate per gallon.

A. B. 2732, introduced by Assemblyman Voigt, starts at 2.1 cents per barrel, increasing to 4.05 cents, with natural gas tax at 18/100 cents per m. c. f. and natural gasoline at that rate per gallon.

Both bills propose administration by the State Board of Equalization, and both contain penalty provisions for failure to furnish tax statements and make payments. If the Board finds delinquencies due to neglect or simple failure to file the returns and the remittance, the penalty is 10 per cent of the tax; if no statements are filed and the Board finds intent to defraud, the penalty is 25 per cent, being the same if a wilfully false statement is filed. In all cases of delinquencies, interest at the rate of one-half of one per cent per month is charged on the amount due.

The tax becomes the first lien on the property, and if it is not paid, the Board may seize the property and sell it at public auction. If the Board deems it necessary, it may require the producer to post security to insure payment of the tax, and it can also call for immediate payment when it feels that a delay would jeopardize collection.

Many other bills in the State Senate as well as in the Assembly, will directly affect the oil industry even though they are not specific oil industry legislation.

In this classification fall the many proposed amendments to workmen's compensation laws, to the income tax laws, to the franchise tax laws, to the unemployment reserves act, and to the relief acts, as well as the new State Fair Labor Standards (wages and hours) act, and the State Labor Relations Act—the "little Wagner Act."

A list of bills specifically aimed at the oil industry, with a very brief summary as to their contents is shown below.

A.B. 12—Donnelly—Exempts sellers of less than 500 gallons from distributors' license.

A.B. 96—Voight and Rosenthal—Taxes aviation fuel; classified same as gasoline. Sets up Aviation Commission.

A.B. 115—Atkinson—New requirements for bonds for motor fuel distributors; permits securing of bonds by property.

A.B. 216—Atkinson—Well-spacing. Permits drilling on 1/3-acre parcels, or less, under certain conditions.

A.B. 218—Atkinson—Same as A.B. 216.

A.B. 420—Rosenthal—Makes pipe lines common carriers and subject to Public Utilities Act.

A.B. 574—Yorty—Permits state to enter oil business; requires 50% royalty from operator when state agrees not to drill offset land; requires minimum 30% royalty from lessee, of tide and submerged lands; 20% on other public lands; permits piers, etc.

A.B. 584—Massion—Requires state to drill public lands; funds therefrom to pensions.

A.B. 668—Watson—Permits flood control districts to be leased for oil.

A.B. 783—Sheridan—Provides for annexation to cities of contiguous submerged lands.

A.B. 1036—Watson—Permits leasing of Newbert Protection District for oil.

A.B. 1195—Voigt—Grants City of Los Angeles tide, submerged and filled lands within city limits but reserves minerals to State.

A.B. 1197—Voigt—Authorizes Division of Highways to erect road signs out of gasoline tax money.

A.B. 1291—Robertson—Clarifies oil leasing of state land devoted to public use.

A.B. 1304—Miller—Permits use of Highway Funds for certain bridge building.

A.B. 1461—Kellems—Same as A.B. 1195.

A.B. 1594—Tenney—Amends 1915 Oil Act by stating that unless casing is removed, well is not abandoned within meaning of Act. (Affects interpretations of oil leases; may affect cost of abandonment bonds).

A.B. 1616—Leonard—Would permit agricultural districts to lease land for oil, or any other lawful business.

A.B. 1595—Tenney—Same as A.B. 1594.

A.B. 1710—Johnson et al— Changes procedure of expenditures of their share of gasoline tax moneys by counties.

A.B. 1777—Collins—Includes oil and industrial wastes in sections of Health and Safety Code relating to garbage; prohibits dumping of same on navigable rivers or in ocean within 40 miles of coast.

A.B. 1778—Collins—Same as A.B. 1777.

A.B. 1821—Voigt, Massion and Doyle —Chain store tax. (Includes service stations).

A.B. 1841—Robertson—Amends method of allocating highway money to counties.

A.B. 1875—Scudder—Public Resources Code, including oil and gas. Codifies existing laws.

A.B. 1880—Scudder—Amends procedure with respect to Oil and Gas Fund.

A.B. 1961—Garland and Burns—Taxes persons owning interests in minerals on basis of $2 per year per acre. (May tax certain royalties in excess of annual income). (May confiscate royalties in wildcat lands).

A.B. 2007—Redwine—Permits school districts to be leased for oil.

A.B. 2009—Redwine—Provides that irrigation districts may be leased for oil.

A.B. 2147—Lyon—Provides for inspection, regulations, specifications, licensing of gasoline tank trucks.

A.B. 2157—Turner—Re-allocates gasoline tax money.

A.B. 2200—Gilmore—Re-allocates gasoline tax money.

A.B. 2360—Miller—Truck tax.

A.B. 2363—Leonard—Raises gasoline tax to 4c per gallon.

A.B. 2364—Leonard—Same as A.B. 2363.

A.B. 2370—Redwine—Permits leasing of reclamation districts for oil.

A.B. 2371—Redwine—Permits leasing for oil of Sacramento and San Joaquin Drainage District.

A.B. 2372—Redwine—Permits leasing of municipal utility districts for oil.

A.B. 2373—Redwine—Permits leasing of public utility districts for oil.

A.B. 2432—O'Donnell—Amends act making subsurface trespass illegal to include "all other hydrocarbons" as well as oil and gas.

A.B. 2473—Reaves—Raises gasoline tax to 5c per gallon.

A.B. 2486—Robertson—Provides for prospecting permits on State lands if not known to be mineral, but State Lands Commission must determine, on receipt of application for permit, whether lands are mineral or not. If mineral, application must be rejected.

A.B. 2593—Miller—Provides for 25% penalty if gasoline tax not paid; for arbitrary assessments; for refunds.

A.B. 2594—Miller—Same as A.B. 2593.

A.B. 2662—Dills et al—Provides that all money remaining in State Park and Maintenance Fund at end of any fiscal year (derived from oil royalties under State Lands Act of 1938) shall be deposited in General Fund.

A.B. 2693—Reaves—Lowers gasoline tax to 2c per gallon.

A.B. 2700—Miller—License fees for commercial vehicles.

A.B. 2735—Tenney—Lowers gasoline tax to 2½c per gallon (but see A.B. 2736).

A.B. 2736—Tenney—Repeals exemption of sales of gasoline from sales tax (but see 2735).

A.B. 2755—Johnson—Repeals requirement for posting gasoline prices.

No. 3 OF A SERIES SHOWING HOW SECURALOY INCREASES DEVELOPMENT EFFICIENCIES

WINDOWS that open to INCREASED PROFITS!

Operators are now developing Secondary Producing Zones more efficiently, more economically and more completely with the aid of "Securaloy"—the drillable oil field metal.

Here is how it's done. The liner string used to produce the lowest production sand is made up with blank "Securaloy" sections opposite *all* other zones that offer production possibilities. This combination steel and "Securaloy" string is then run in the hole and cemented above the lowest producing zone (fig. 1), thus sealing off all undesired water, gas, and secondary oil zones.

The lowest zone is produced until it becomes depleted—or until it is thought desirable to open up the secondary zones. If depleted, the "Securaloy" liner section in this lowest zone is drilled up and the formation cemented off. The "Securaloy" window opposite the next lowest zone (together with the cement sheath behind it) is then completely cut away with a wall scraper.

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With the bottom zone plugged off and one of the secondary sands thus completely exposed to production, a new "Securaloy" liner or screen of smaller diameter can be set opposite this zone and production obtained with maximum efficiency (fig. 2). Thus, full drainage area is secured—an important advantage over producing through casing perforations—and the entire zone can be periodically scraped to open up fresh unclogged formation. Moreover, the liner can be reconditioned or replaced, as desired, thereby assuring unrestricted flow and complete recovery. The remaining sands can be progressively exposed and produced in the same manner by removing the "Securaloy" windows which blank off these zones.

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Furthermore, should it later be desired to explore for other zones, the use of a drillable "Securaloy" top section permits the hole to be diverted at this point and drilling operations to be carried around the steel sections in the hole to greater depths or other locations with minimum effort and maximum safety.

Our Engineering Department will be glad to supply further details on any "Securaloy" application and to work with you on your particular problem. Write, giving full details!

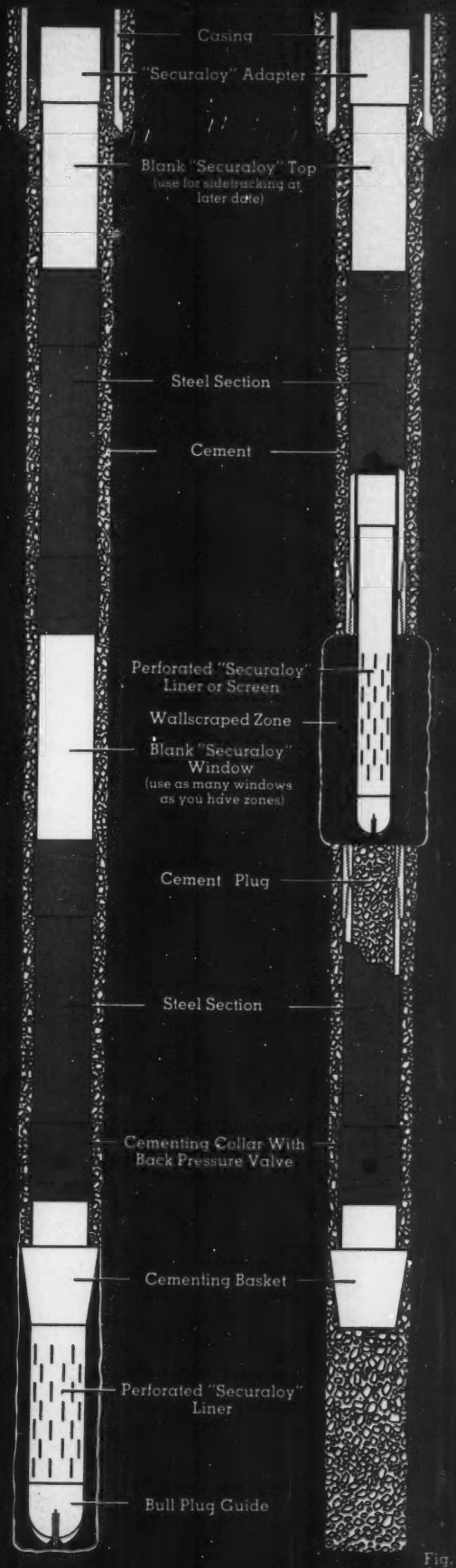

Fig. 1 Fig. 2

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Sievers Reamers ★ Securaloy ★ Security Drillable Products

S.B. 31—Hollister—Requires Highway Commission to build fences along roads to protect livestock.

S.B. 352—Biggar—Adds one cent to gasoline tax for highway construction and reconstruction fund.

S.B. 416—Kenny—Abolishes Division of Lands in Department of Finance; creates position of secretary (executive officer) of State Lands Commission to administer State Lands Act of 1938.

S.B. 847—Breed—Grants Highway Commission wider latitude with respect to acquiring roadways and other property.

S.B. 874—Biggar—Increases gasoline tax to 7c per gallon, effective July 1, 1939.

S.B. 894—De Lap—Amends language concerning non-taxable gasoline sales.

S.B. 895—De Lap—Permits refunds for handling losses on tax paid gasoline.

S.B. 896—De Lap—Provides for 1% deduction by distributor from license fee for evaporation.

S.B. 998—McBride—Changes allocation of gas tax money to counties and cities.

S.B. 999—McBride et al—Provides new procedure for budgeting expenditures from gasoline tax fund.

S.B. 1050—Biggar—Provides new allocations of gasoline tax fund; limits amount any city or county may receive in one year.

S.B. 1076—Law—Provides for refunds of gasoline taxes.

S.B. 1077—Law—Same as S.B. 1076.

S.B. 1087—Westover—Changes allocation of revenue received by Department of Motor Vehicles.

M. Albertson Heads Special Well Spacing Study Group

M. Albertson, of Shell Petroleum Corp., Houston, Texas, has been reappointed national chairman of the American Petroleum Institute's Division of Production Special Study Committee on Well Spacing of the Central Committee on Drilling and Production Practice.

Membership of the committee follows: G. S. Bays, Stanolind Oil & Gas Co., Tulsa, Okla.; W. B. Berwald, U. S. Bureau of Mines, Bartlesville, Okla.; **J. G. Burtt, Shell Oil Co., Los Angeles, Calif.; W. S. Eggleston, Union Oil Co. of California, Los Angeles, Calif.**; H. H. Hardison, Standard Oil Co. of Texas, Dallas, Texas; M. G. Cheney, Anzac Oil Corp., Coleman, Texas; F. E. Heath, Sun Oil Co., Dallas, Texas; N. M. Hutchinson, Cities Service Oil Co., Bartlesville, Okla.; D. R. Knowlton, Phillips Petroleum Co., Bartlesville, Okla.; and Edgar Kraus, The Atlantic Refining Co., Carlsbad, New Mexico.

Also **G. V. D. Marx, Standard Oil Co. of California, San Francisco, Calif.; H. C. Miller, U. S. Bureau of Mines, San Francisco, Calif.**; T. V. Moore, Humble Oil & Refining Co., Houston, Texas; W. S. Morris, East Texas Engineering Assn., Kilgore, Texas; E. L. Rawlins, Union Producing Co., Houston, Texas; C. E. Reistle, Jr., Humble Oil & Refining Co., Houston, Texas; **L. C. Uren, University of California, Berkeley, Calif.**; C. D. Watson, The Carter Oil Co., Tulsa, Okla.; F. E. Wood, Standard Oil Co. (Indiana), Chicago, Ill.; and R. D. Wyckoff, Gulf Research & Development Co., Houston, Texas.

Myers Appointed Member Refinery Corrosion Group

Norval F. Myers, manager of refineries, Union Oil Co. of California, Los Angeles, California, has been appointed to membership on the American Petroleum Institute's Division of Refining Committee on Corrosion of Refinery Equipment. He succeeds L. G. Metcalf, resigned.

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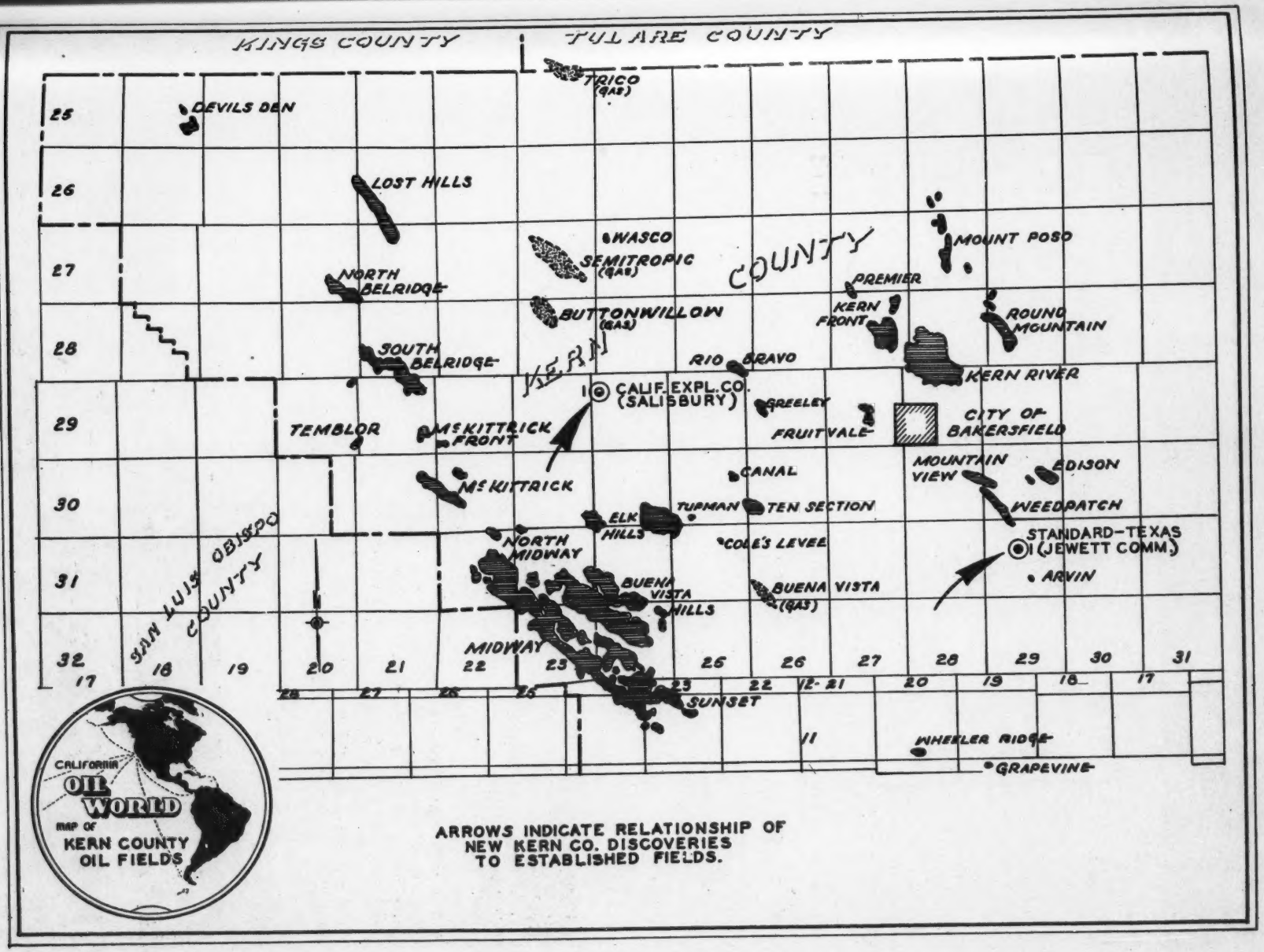
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KERN COUNTY
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TEN SECTION
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COLE'S LEVEE
NORTH MIDWAY
BUENA VISTA HILLS
BUENA VISTA (GAS)
MIDWAY
SUNSET
MOUNT POSO
PREMIER
KERN FRONT
ROUND MOUNTAIN
KERN RIVER
MOUNTAIN VIEW
EDISON
WEEDPATCH
STANDARD-TEXAS (JEWETT COMM.)
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CALIFORNIA OIL WORLD
MAP OF KERN COUNTY OIL FIELDS
ARROWS INDICATE RELATIONSHIP OF NEW KERN CO. DISCOVERIES TO ESTABLISHED FIELDS.

LAUGH THIS OFF

Away out at a little wayside service station on the edge of the Mojave Desert, we spotted this highly illuminating sign the other day, "Don't ask us for information. If we knew anything, we wouldn't be here."

And from **Bill Ackerman** comes the amusing story of a Los Angeles oil man who recently went north to attend the opening of the Exposition. He decided to take a ferry out to Treasure Island, and arrived at the wharf just as one was pulling out. Evading all the attendants, he galloped down the runway, took one terrific leap, and landed on the boat all right, but he landed so hard that he knocked himself out. When he came to some minutes later, he looked back at the pier and muttered, "Boy, oh boy, can I jump?"

Gordon Reed tells us also that the weather prognostication for the Bay City from now on is, "Fair today, and fair tomorrow."

The boys down around Dominguez Hill used to call **Bud Driesback's** old hoopie "Never" because it was to late to mend.

And we understand a motor cop once stopped him as he was driving along the highway, and asked him if he had reported the accident.

Which recalls a conversation that took place in the bunkhouse a few nights ago. Two rousties were discussing the transmissions in the new models. Says one, "Did you ever lie under a Buick and look up at the mechanism?" Replies the other, "Naw, sir, I'm too quick for them."

Then there was the production superintendent who asked his good-looking stenographer, "Are you doing anything Sunday night, Miss Smith?" "No," she replied hopefully, and you could have knocked her over with a six-inch elbow when the boss suggested, "Well, try to be in the office earlier on Monday."

Frank Coyle now tells us about a little oil field cafe down Long Beach way that is called "The Expansion Joint."

And **Red Wilson** declares that one of his gaugers dreamt the other night that he was eating shredded wheat, and woke to find half the mattress gone.

We have often wondered, incidentally, if the idea of shredding wheat was developed by some laundry proprietor.

Reminding us of the little hand laundry out in Whittier that advertised, "We cut your laundry in half."

A few days ago, according to one of our field operatives, a local production boss was called to inspect a temporary sump with a view to erecting a regular concrete skimming basin in its stead. He asked the pumper if the bottom was pretty solid, and the latter replied, "Oh yeah—she's as solid as a rock." The boss being a man of action promptly put on a pair of waders and walked in to take a look at some pipe connections. To his surprise, he sank slowly to his waist in the gooey mess, and as he did so, he yelled at the pumper, "You numskull, I thought you said the bottom was solid." "It is," said the latter, "the trouble is you ain't come to it yet."

And that brings us to **Herb Eggleston's** story of the refinery operator who has saved enough money to go on a vacation to Europe, and has decided to start just as soon as he can save enough money to get back.

A vacation, of course, for some people is just a change of loafing place.

But after all, perhaps a half a loaf is better than no vacation at all.

It is rumored that the wife of a local oil executive was recently granted a divorce with alimony because her husband snored. That's what you might call paying through the nose.

Alimony, as you know, being the cash surrender value of a marriage certificate.

All of which brings us once more to the parting of the ways. Remember, in conclusion, the service station operator is not really trying to be fresh when he gives you the air.

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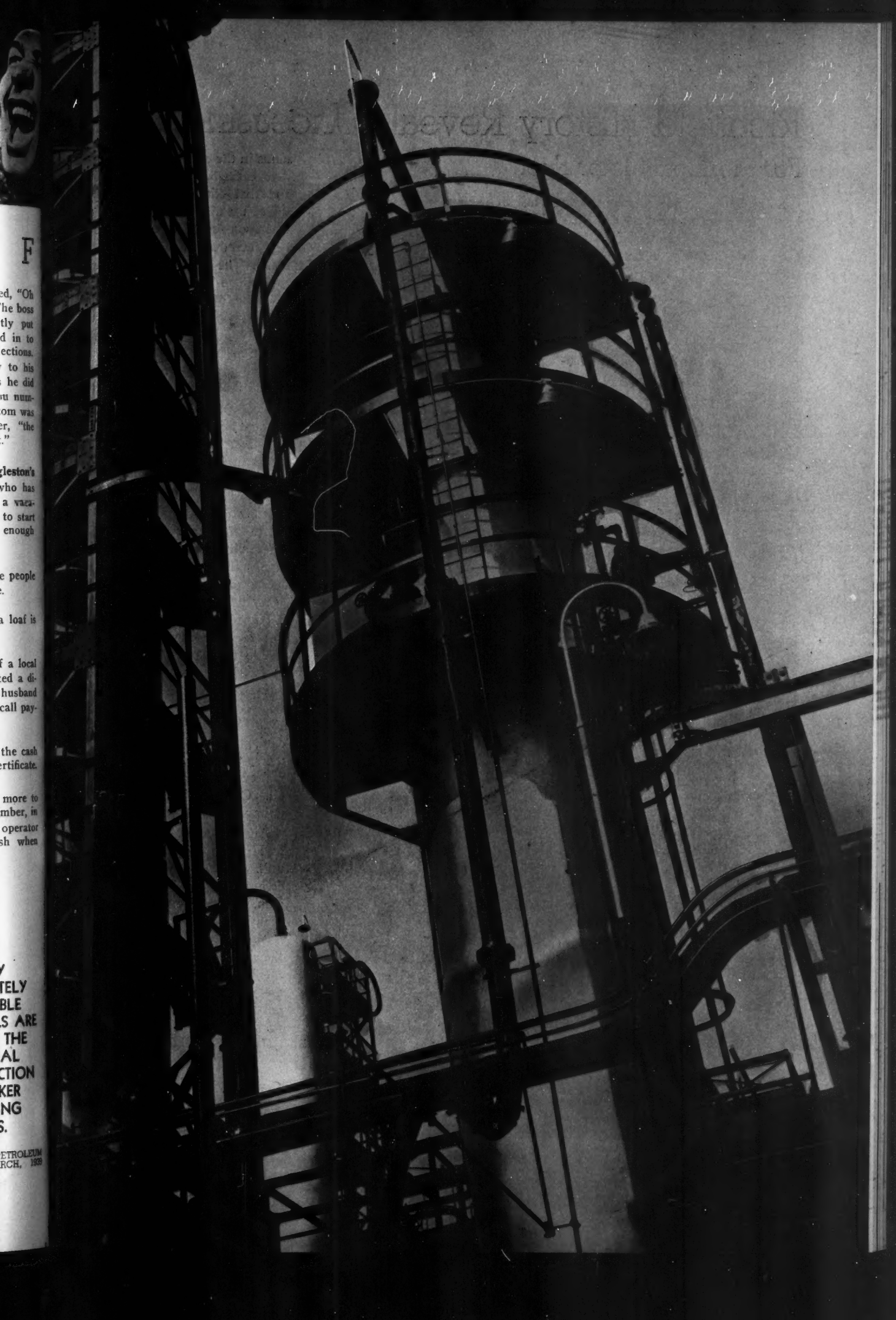
ONLY COMPLETELY DRILLABLE MATERIALS ARE USED IN THE INTERNAL CONSTRUCTION OF BAKER FLOATING UNITS.



Richfield History Reveals Unceasing Quest

For the Ideal Motor Fuel

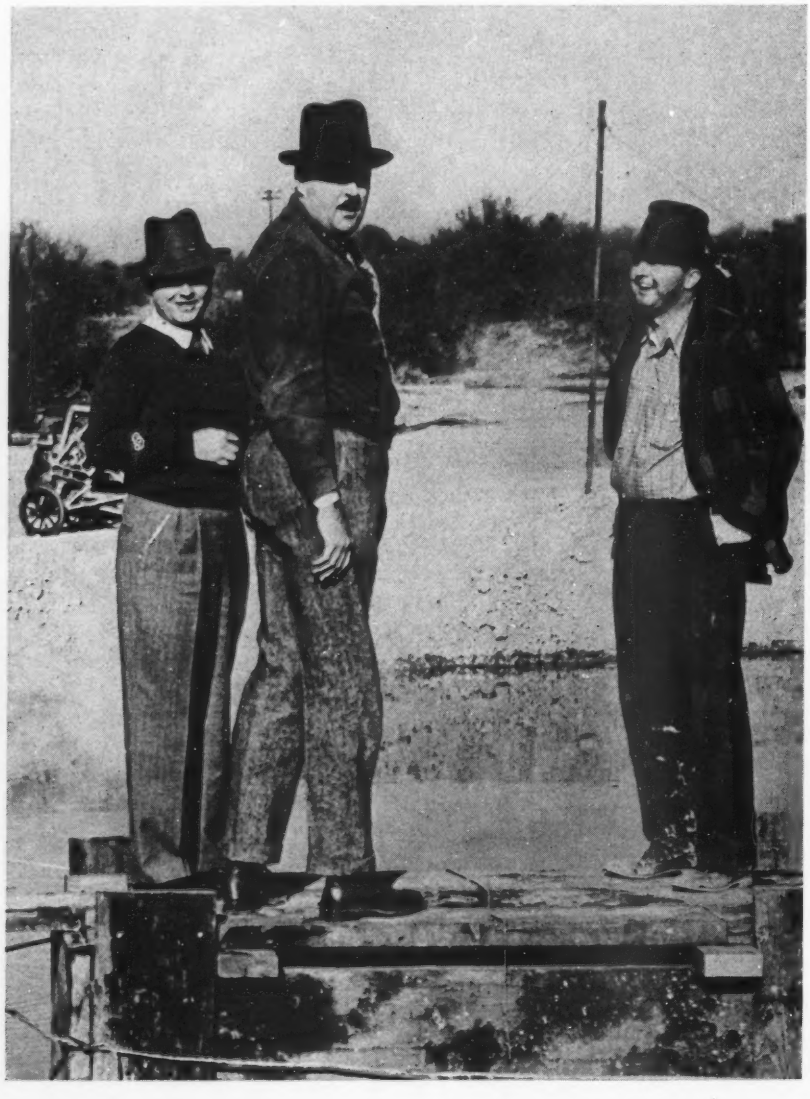
Long before refiners, particularly in the sales department, started talking about octane numbers, high test, and quick starting, Albert Kelley, Tony Panero and Bert Goza were establishing the fact that the best proof of a gasoline's quality is road performance. Kelley, who entered the industry in 1910 as bookkeeper for Barlow & Hill, and joined Richfield in 1914, was in charge of Richfield Oil Co.'s refinery at Bakersfield from the beginning, and Panero was his superintendent. Any gasoline above the naphtha cut would do for most of the automobiles of that day, but that wasn't the kind of motor fuel Kelley and Panero felt that Richfield should produce. They knew that high compression, maximum efficiency, engines would soon pass from the confines of the racing and aviation fields and enter public demand.

The future vice president and superintendent of Richfield Oil Corp. began making gasoline that would win races in the air, on the track and on the water. They designed a continuous operation shell still equipped with one of the first bubble cap columns in the oil industry. They found that casinghead gasoline added zip, and that elimination of heavy ends solved the dilution problem. Richfield was soon forced to expand its refining facilities to meet growing demand. The refinery at Hynes was decided upon in spite of the misgivings of some of the company's officials. The new plant was to have a daily capacity of 10,000 barrels. The installation was over designed and started immediately on a production schedule of 12,500 barrels daily.

Richfield's success with the shell still and bubble column spurred Kelley and his staff to further developments in the art of fractionation. A pipe still, one of the first for petroleum products, was designed and the specifications were submitted to one of the industry's leading fabricators. The fabricators refused to build the pipe still unless Richfield would assume full responsibility for possible (they felt certain) failure of the unit to function as intended by the designers. Richfield's new pipe still and bubble towers exceeded expectations by 2,500 barrels, and to keep up with increasing sales were added, successively, two 10,000-barrel units and a 15,000-barrel unit. The plant was equipped with four Cross cracking units, two hot oil and two cold oil recirculating taking kerosene and gas oil. One of the first vapor recovery units was installed at this refinery.

Another innovation at the refinery at Hynes was the Lachman treating unit. This was the zinc chloride process developed by Dr. Arthur Lachman, of the University of California chemical laboratory, and Richfield refinery engineers. Gasoline treated by the new method conserved its octane number, was reduced in gum content, and given color stability. Treating costs were reduced from 14 cents a barrel to 6 cents a barrel.

In 1928 Richfield acquired all of



Center, Richfield's president, Charles S. Jones; left, Albert Kelley, in charge of refining, and right, Al Donneley, production superintendent, at the site of the Richfield-Western discovery well.

the voting shares and much of the Class B, non-voting issue, of Pan American Western Petroleum Co., from E. L. Doheny, for a reported sum of $7,500,000. If East Texas had not come in sending crude oil and gasoline prices to the lowest level in decades, the Pan American purchase might not have set the young company on the path to receivership and reorganization. The Pan American acquisition gave Richfield lube and asphalt plants, a marine terminal at San Pedro, a pipe line into the Midway oil field, scattered production, and large inventories of refined products.

By 1929 the Hynes and Watson refineries were running 100,000 barrels of crude daily, and heavy volumes of products were moving through Richfield's eastern subsidiary. The eastern Richfield owned a refinery at Clarendon, Pa., where Richlube was made, and had marine terminals at Baltimore, Philadelphia, Bayonne, Green Point, Providence, and Schenectady. Gasoline sales in the east reached 18,000,000 gallons monthly, and other sales came to $240,000 monthly.

Many years have passed since Roscoe Sarles won a race at Ascot Speedway with Richfield gasoline to become the first of many notables from Fred Frame to Lindbergh who were to figure in Richfield advertisements. The spirit of pride in Richfield has in no wise dimmed, however, and the new $5,000,000 refinery at Watson is proof.

Who are the men who make Richfield? The president of the corporation is Charles S. Jones, who became associated with Rio Grande (merged with Richfield) in 1916. He was elected a director in 1918, and in 1923 was made vice president and treasurer. In 1932 he was elected president of Rio Grande. He is a member of the board of governors of the Pacific Coast Petroleum Agency, and in addition to many other civic and industrial honors that have been conferred on him, he is a member of the board of the Los Angeles Chamber of Commerce, and chairman of the Transportation committee.

W. T. Dinkins

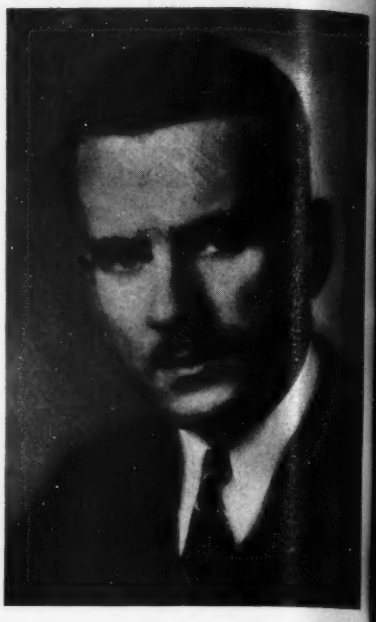
Albert M. Kelley, vice president, entered the industry as bookkeeper for Barlow & Hill, Bakersfield, in 1910. This company managed Section 25 Oil Co., Safe Oil Co., B.H.C. Oil Co., Good Roads Oil Co., and

Personnel of the Sinclair staff: Appearing from left to right, seated: W. S. Gullette, Development Department Engineer, acting as Richfield contact man, in California, with contractors during design and construction; W. Mendius, development department fractionating engineer; T. B. Kimball, development department cracking engineer; E. C. Herthel, manager of development and research department. Standing: O. F. Campbell, combustion engineer; W. M. Flowers, development department cost engineer; O. G. Kaasa, instrument engineer; H. C. Kuhn, inspection engineer; W. C. Poole, electrical engineer.

Kern-Midway Water Co. In 1914 and 1915 he was auditor for National Petroleum Co., and Richfield Oil Co., then a California corporation. From 1915 to 1917 he was Richfield's comptroller, and from 1917 to 1923 he was district manager of refining and sales for Richfield, stationed at Bakersfield. From 1923 to 1931 he was manager of manufacturing, pipe line and marine departments of Richfield, which in that period became a Delaware corporation. He held this position during the receiver and trusteeships.

In charge of Richfield's sales is W. T. Dinkins, vice president. Dinkins came to Richfield via Sinclair Oil Co. in which he held important posts in the East and Mid-Continent.

Since the days when the struggling young company was finding it difficult to obtain enough crude oil to meet its requirements, Richfield has sought to establish itself in a strong position in the matter of petroleum reserves. Just before the reorganization of the corporation, potential production owned by Richfield amounted to 20,000 barrels daily. Today the potential production figure has risen to 56,000 barrels daily, and promises to go much higher as exploratory work continues intensively.



Frank A. Morgan

Heading the exploration work is Frank A. Morgan, a native son, who following his graduation in 1920 from the University of California, began serving various oil groups as consulting geologist and petroleum engineer. It was in this capacity that he assumed the responsibility for the drilling of Elwood field. He was made chief geologist of Richfield in 1929, and recently, vice president. R. D. Montgomery is in charge of the production department.

Recently Richfield further strengthened its crude reserves position when a five-year contract was signed with Union Pacific Railroad to take up to 20,000 barrels of crude oil daily from the railroad's prolific properties at Wilmington. Constituting one of the largest deals of its kind ever consummated between a major oil company and a railroad company on the Pacific Coast, this contract involves something over 54,000,000 barrels of crude and fuel oil. Through this agreement Union Pacific secures a permanent market for its crude oil production, and obtains an ample supply of fuel oil for its railway lines in the Pacific Coast area.

(*Continued on page* 58)

H. F. Sinclair, chairman of the board, and son, Harry F. Jr., on a recent visit in Los Angeles.

RICHFIELD SELECTS DAYTON ☆ DOWD *Centrifugal Pumps*

Completion of the Richfield Oil Corporation Refinery Watson, California, marks another step ahead in odern refinery operations—and *another* high mark for yton-Dowd Centrifugal Pumps!

Cooling towers are a vital part of refinery operations, l when the water supply to them stops, the refinery ocesses also stop. That's why Richfield engineers in- ed against costly shutdowns by installing this battery four 18" Type A-25 Dayton-Dowd Pumps. Each has a pacity of 12,000 gallons per minute, and circulates the ter through the towers against heads of 75 and 110 t at varying temperatures!

Dayton-Dowd Centrifugal Pumps embody the most anced principles of modern pump design. They are built by an organization that specializes in centrifugal pumps exclusively. Every phase of manufacture, including research, engineering, pattern making, steel and brass fabricating, machining and assembling is carried on in one large manufacturing plant. A modern, fully equipped testing laboratory is also maintained to accurately check every item upon which smooth operation depends. Thus, absolute uniformity is assured in the construction of every Dayton-Dowd Pump!

Dayton-Dowd Centrifugal Pumps are available in a wide range of sizes and models for handling different types of fluids. Each is designed to give greater efficiency, dependability and long life at lower operating cost.

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QUINCY, ILLINOIS U. S. A.

Completion of Richfield's New Refinery

Triumph in Engineering and Construction

In the laboratory gasolines have been produced which compensate for engine and auxiliary equipment vagaries under different operating conditions. Gasolines which give unprecedented performance in all the speed ranges, climatic conditions, and driving techniques. But that was in the laboratory, and it was not until polymerization reached the commercial stage and the art of blending light cracked ends to form a stable product was developed, that refiners began to see the production of these super motor fuels as possible on a profitable large scale basis.

When Richfield Oil Corp. was reorganized early in 1937, consolidating the assets and properties of the Richfield Oil Co. of California, the Pan American Petroleum Co., and the Rio Grande Oil Co., the new corporation had three refineries: the Pan American plant at Watson, the Richfield plant at Hynes, and the Rio Grande plant at Vinvale. Economy dictated that the major expansion program necessitated by the new corporation's business should be centered at one point and not dispersed among three plants covering a single area.

Watson Selected

In the reorganization proceedings the new corporation had entered into a management agreement with the Sinclair Refining Co., under which Richfield could call upon Sinclair for engineering services. Consequently the Sinclair Development Department was requested to survey Richfield's existing facilities and make recommendations as to a proper solution of the refinery consolidation problem. In their study, several aspects of the problem were considered, and economic balances were prepared for each plan. The rehabilitation and operation of existing equipment was studied and rejected as economically and technically unsound. Not only would the higher cost of operating old equipment outweigh the resultant savings in capital investment, but products of the high quality demanded by the new organization could not be produced in the type of equipment available.

Finally, after a detailed study of all the plans submitted, the Richfield management decided to concentrate its manufacturing operations at the Watson location, keeping Vinvale intact for operation if and when required. The Rio Grande plant at Vinvale had been modernized in 1934, and was equipped with up to date cracking facilities, but its capacity was not nearly adequate to turn out the products required by the new corporation's sales program. An expenditure of $5,000,000 was authorized for the Watson expansion program. This decision was made in May, 1937, and immediately thereafter design work was started and specifications were released to contractors for bid.

C. F. Braun & Co. Named Builders

Major contracts for the work were awarded July 14, 1937. C. F. Braun & Co., of Alhambra, Calif., received orders for the construction of two combination crude distillation and cracking units, a debutanizer, a hydrogen sulphide removal plant, a polymerization plant, and a caustic wash unit. Other work let to Braun included the revamping of an existing crude battery and the rehabilitation of the electrical and water systems. The Bechtel-McCone-Parsons Co., of Los Angeles, was awarded the contract for rebuilding the gasoline rerun unit.

The first step in the construction pro-

gram was, of course, the drawing up of detailed engineering plans. One of the most impressive features of the new unit is the fundamental soundness of its engineering. This is a distinct tribute to the close cooperation between Sinclair's engineering staff, representing Richfield, and the contractors' engineering organizations.

The construction site was cleared in August, and building actually began about the middle of September, 1937, when ground was broken and the first concrete was poured. In a construction program of this size it is extremely important to keep material and equipment moving in as required. This is difficult enough under the best circumstances, but this job was further complicated by the heavy rains and resultant floods of the spring of 1938.

The modern refinery uses equipment so large as to constitute a major transportation problem, and this was no exception. Seven evaporating and fractionating towers were required for each of the two combination units. The largest of these, two main bubble cap towers, are thirteen feet in diameter by sixty feet high, and weigh 250,000 pounds each. Transporting these towers from the Braun fabricating shops to the refinery site necessitated one way traffic over the railroad, as the towers, when loaded on flat cars, would not clear passing cars on adjacent tracks. With these handicaps, some anticipated and some unexpected, the job moved slowly during the early spring and it appeared that the completion date of Aug. 1, would be difficult to meet.

High temperatures call for these.

Job Goes Steadily Ahead

In June the rehabilitation of the electrical and water systems had been completed by Braun, and the steam plant had been overhauled and modernized by the Watson refinery maintenance department. In July the rebuilt crude and rerun units were finished by Bechtel-McCone-Parsons, and turned over to the operators, who successfully put them into operation during the first part of the month. During this period, the carefully picked men who were to operate the combination units for Richfield were given thorough training in their new duties. This included sending key men to Sinclair refineries to acquire actual operating experience with similar equipment. The men who were to operate the plant went over the unit each week during the final stages of construction, and became familiar with every engineering detail. Everything was done to prevent any possible slip-up in putting the big units on stream.

The first of the two combination units was not ready to operate on Aug. 1, but the equipment was given hydrostatic tests during the first week of that month. These tests showed no leaks so the unit was put on cold oil recirculation. This test period was prolonged while awaiting completion of control instrument connections, hot oil pump room ventilation system and other miscellaneous items. During this period all pumps were "run in", leaky valves repacked, control equipment adjusted, and careful inspection made of all mechanical equipment. This in itself was no small job when one considers that there were fifty pumps, over one hundred major valves, and some forty miles of piping to be checked and tested.

No Bugs Encountered

The battery of heaters was fired for drying out purposes during the recirculation period and on Aug. 19, firing for actual operation was commenced. It is axiomatic in the refining industry that a certain amount of trouble will be encountered in bringing a big combination unit on stream for the first time, but the first of the two big combination units came up to operating conditions without a hitch. By midnight of Aug. 20, finished gasoline was going into the tanks. By morning, the starting up crew, who had been on the job continuously for over twenty-four hours, turned the job over to the regular operators. Within twenty-four hours more the big combination unit was turning out products in excess of the original design and running like a top.

The second of the two combination units was completed, tested, and put on stream early in the morning of Sept. 9. Here, again, no operating difficulties were encountered. The big unit went right to work and started putting out more products than original design called for.

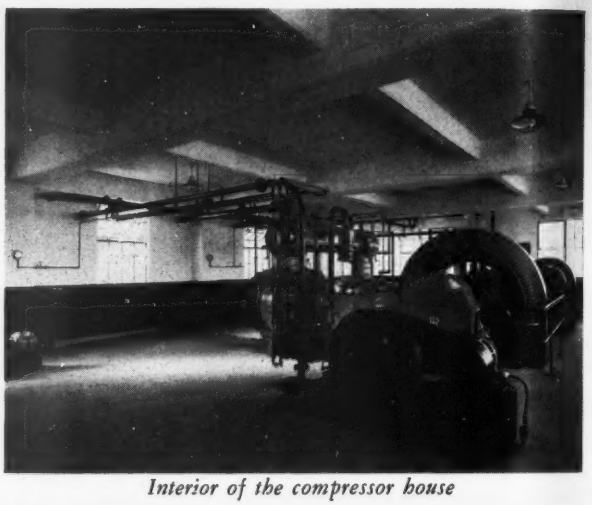
Both stills were kept on the line for thirty days and then brought down for routine inspection. The fact that not one, but two units of this size started up and produced designated products without requiring any shut-downs due to erroneous design, poor workmanship, or faulty operation is a very considerable achievement. It was not due to luck, nothing had been left to chance. It was due to sound engineering design, excellent construction, careful and rigorous inspection,

8 Reasons

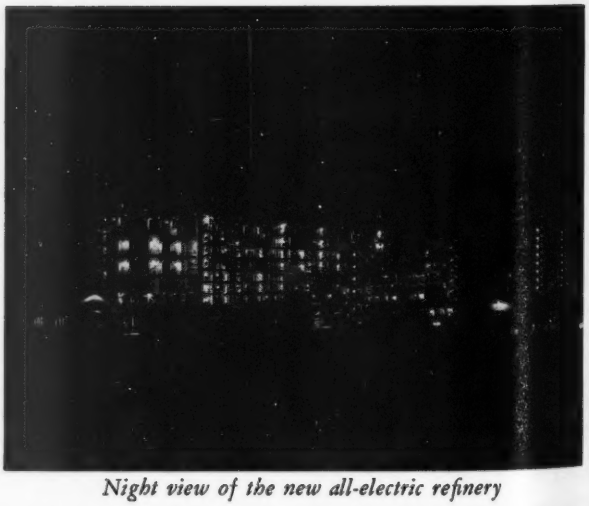
...why the new Richfield Refinery is ALL-ELECTRIC

1. lower cost of electric equipment
2. lower installation costs
3. lower operating costs
4. lower maintenance costs
5. ease of operation
6. dependability of operation
7. less floor space required
8. low cost of Edison power

Night view of the cold pump-room



Interior of the compressor house



Night view of the new all-electric refinery

The completion of the Richfield Oil Corporation's new $5,000,000 refinery, the largest electrically operated refinery in the world, marks another outstanding achievement by the California oil industry.

One of the most modern and efficient plants of its kind ever built, it embodies many new and unusual developments in refinery construction and operation. Much of the equipment, including two giant 1000 horsepower electric motors, was designed and made especially for the new plant and is different from any other equipment now in use.

Electric power was selected to operate the refinery because of the tremendous savings possible on motor installation costs, operating costs and maintenance costs, and because of the ease of operation, dependability and efficiency of electric equipment.

Investigate the many advantages of electric power in the oil industry. The Edison Company maintains a staff of engineers experienced in the application of electricity to refinery operations, oil well pumping, etc. There is no charge for their advisory services. Just call the nearest Edison office.

SOUTHERN CALIFORNIA EDISON COMPANY LTD.

3-39

Equipment like this caused many railroad traffic headaches.

thorough training of the operators, and complete cooperation between the staffs of Richfield, Sinclair, and Braun.

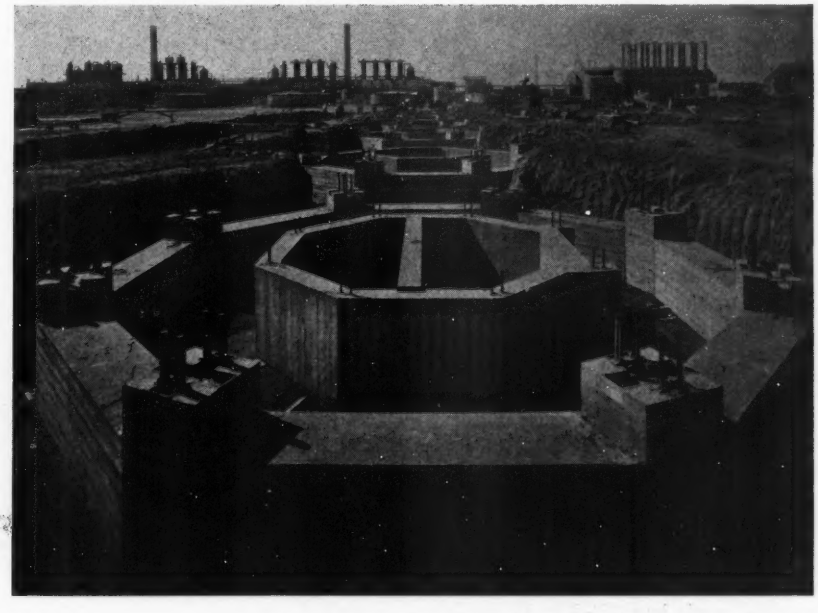
Centralized Control of Units

The two combination topping and cracking units have a common pump house and control room. This layout allowed for common spare pumps, cooling boxes, and other incidental items, centralizing, as well, control of the units and simplifying tie-in with the balance of the refinery. The plant is built for running a wide variety of California crude oils, with sufficient flexibility to handle extraneous reduced crude, gas oil, and other stocks available from the rebuilt crude topping units. Flexibility in feed stocks is secured mainly by allotment of heat exchange and the use of a dual-fired heater, charging crude on one side and reduced crude, including extraneous feed, through the other.

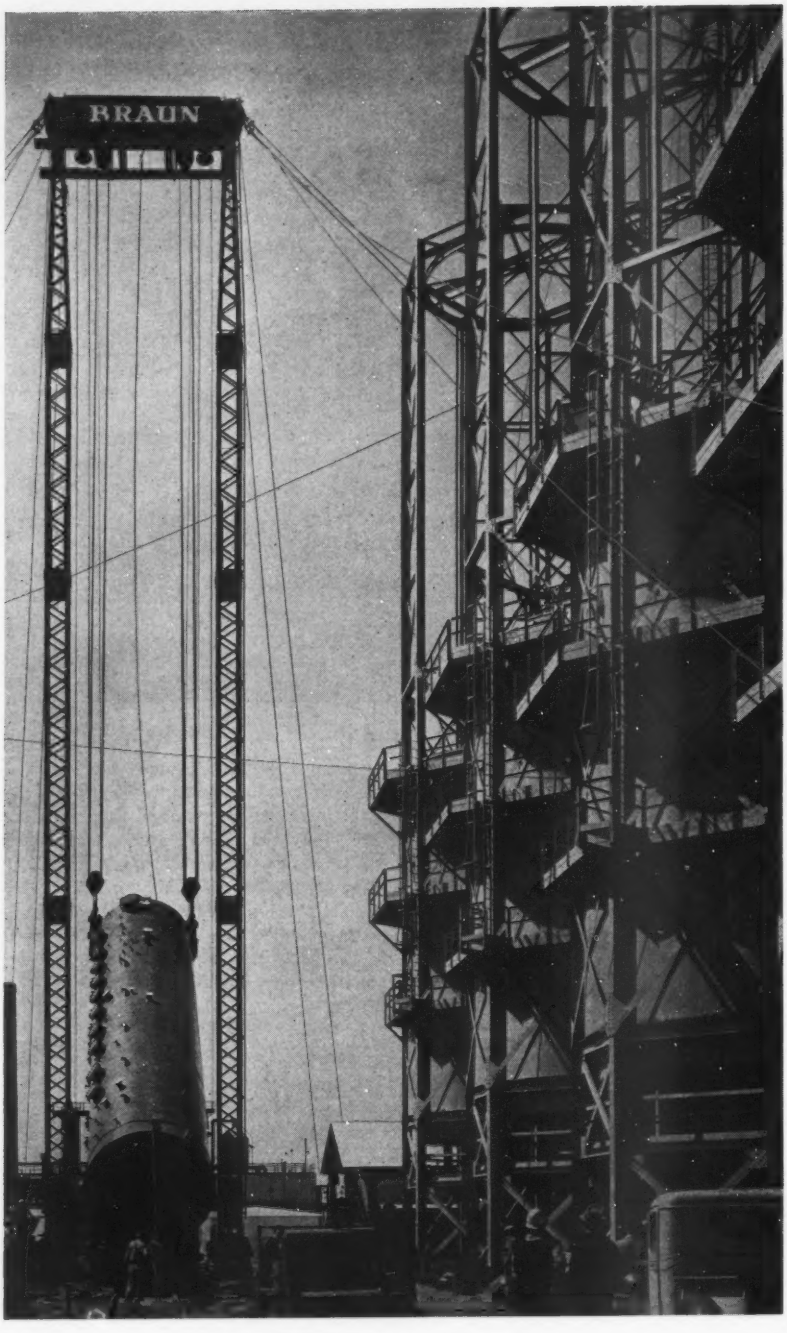
Capacities and Flow Plan

Each unit is capable of charging 25,000 bbls. per day of crude and reduced crude oil, the variations in the charging stock ranging from as high as 20,000 bbls. crude plus 5,000 bbls. reduced crude, as one extreme, to 10,000 bbls. crude and 15,000 bbls. reduced crude, as the other. Flow of the operation is as follows: Crude charging pumps, taking suction on a 16 in. line, discharge at 300 pounds through automatic flow controller to exchange, heat being furnished by circulation of upper side streams from the main fractionating column. This initial preheat is to a controlling temperature of 300° F. from whence the oil flows into a salt settler with a capacity approximating one half hour settling time. Back pressure of 250 pounds is maintained on the salt settler to suppress vaporization. Water is drawn off automatically through level controls.

Following salt settling, the crude flows to additional exchange against tar evaporator overhead vapors and circulating heat medium from the bottom of the main fractionating column, thence to one section of the feed heater. With clean exchange, firing on this side of the heater is very light, approximating 15,000,000 B.t.u.'s per hour, with a potential of 35,000,000 B.t.u's. Thus considerable leeway is available for dirty exchange or for handling any variation in crude quality



deFlorez heater foundations.



The plant goes up in record time.

requiring higher flash temperatures. A parallel flow is used through the crude side of the heater by means of four-way header boxes. With a pressure drop of approximately 60 pounds, no difficulty is experienced with flow through the parallel paths.

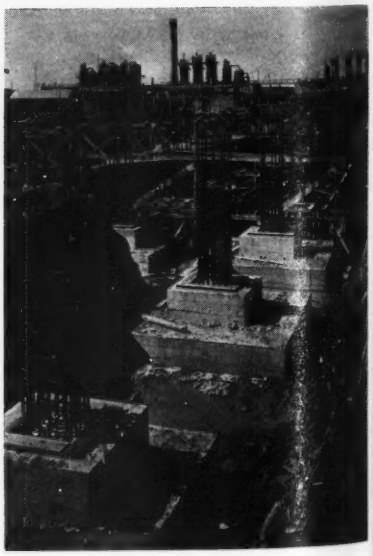
Oil to Crude Flash Tower

Discharge from the heater is directly to the crude flash tower which fractionates the crude into 350-400° F. endpoint overhead, a kerosene distillate side stream which is steam stripped, and reduced crude bottoms testing approximately 15-18° gravity, depending upon the type of crude charged and the quality of side stream removed. This reduced crude bottoms, together with extraneous reduced crude from tankage, serves as the main feed stock to the cracking cycle.

Suction is taken on the bottom of the crude flash tower (the level of which is controlled automatically by feeding extraneous reduced crude from tankage) by centrifugal pump discharging at 300 pounds pressure through tar exchange and thence to the other half of the feed heater where the material is heated to plus or minus 700° F. and discharged into the cracking cycle. The residue from the cracking cycle is flashed in the vacuum evaporator under reduced pressures. The asphalt bottoms produced from this operation are released by automatic level control on the discharge of the pump through exchangers against reduced crude. They are blended with the cracked recycle gas oil immediately after exchange, and thence flow through the tar coolers to tankage. By control of this operation a wide range of gravity and viscosity specifications can be met. The fuel is characteristically low in B. S. & W. and sediment, and is extremely stable even when blended to low viscosities.

Vacuum Evaporator Overhead

The condensed overhead from the vacuum evaporator is discharged directly to the bubble cap tower and furnishes the main part of the heater flow. Level in the main fractionator of the cracking cycle is maintained by extraneous gas oil feed which can be a part of the vacuum evaporator overhead previously released to tank or extraneous gas oil from lube or other refinery operations. The heater feed is picked up with a 1,000 H.P., 6-stage centrifugal pump from the bottom of the fractionator and discharged through three deFlorez down-fired heaters. Here the oil is preheated to cracking temperatures and released into a common transfer line, discharging back into the cracking towers. The main fractionator removes a 400° F. endpoint cracked distillate, as an overhead product, and a stripped recycle gas oil side stream which is used in part to blend with fuel. A portion of this stripped material after crude



Receiving house center foundations.

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exchange, as previously described, is also cooled for circulation over the absorber. The balance is removed to tankage to augment refinery gas oil supply.

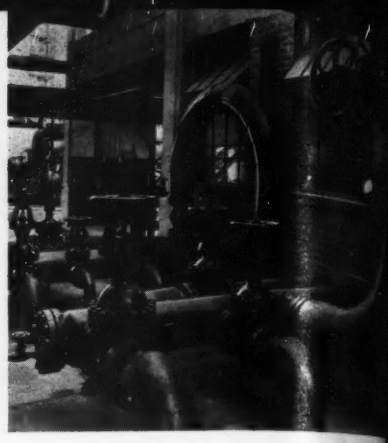
The units are well laid out, following a natural flow which is a result of cracking still development covering a wide range of experience. For example, the overhead cracked distillate flows down through submerged condenser sections located on the roof of the control room, and thence through aftercoolers into receiving drums which are located on the deck of the control room floor. Gas is released from the receiving drums into individual absorbers with the distillate flowing through overhead lines direct to the debutanizer feed drums located at ground level. Reflux pumps located immediately below the receiving drum deck take overhead suction on the receiving drums and discharge back through the control manifold located on the still side of the control deck, and thence to the top of the bubble cap towers. Other products, similarly, assume this natural flow.

Control of Units

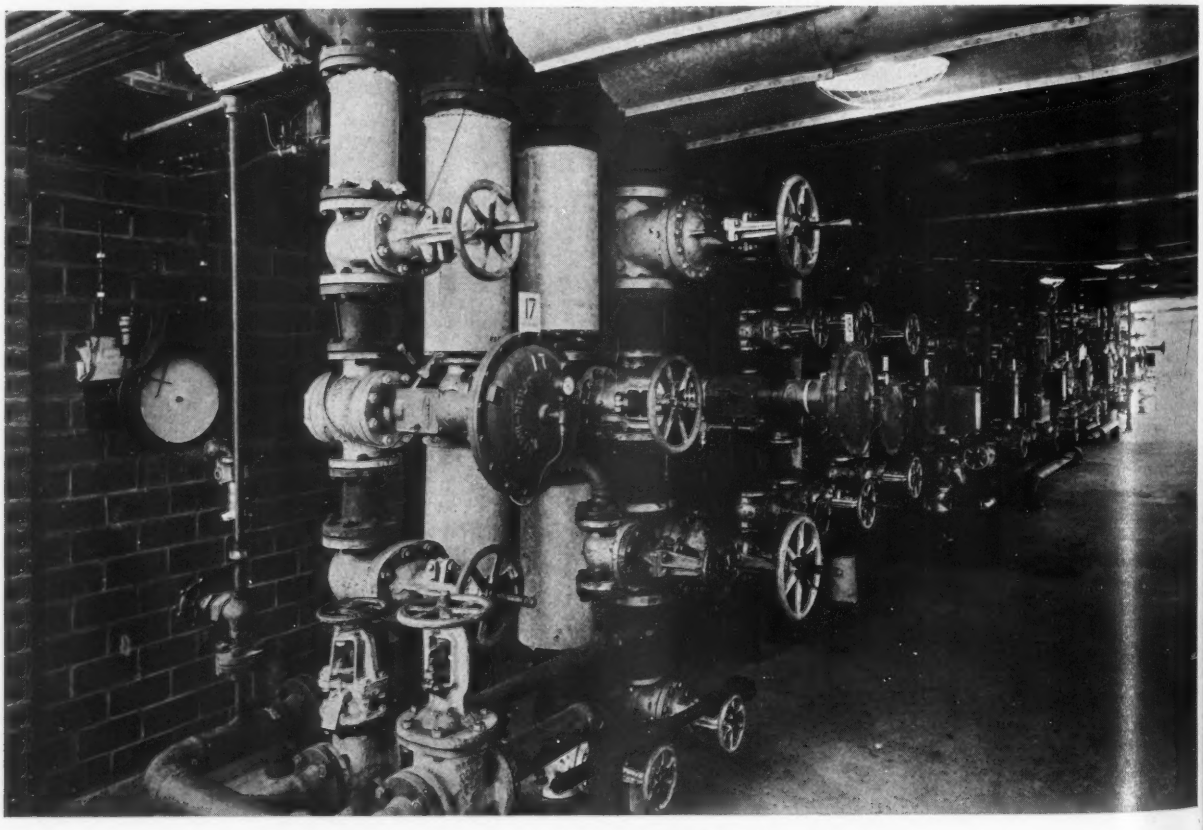
The essential control of the units is automatic, having the latest instrumentation in level, temperature, flow, and other automatic devices. All instruments are placed in the central control room which is located to give ready access to all parts of the unit by interconnecting walks and stairways. Heater feed is controlled by electrically operated motor valves, guided by indicating flow meters. This choice of control rather than air actuated flow controls was made since the valves will remain set in position upon power failure, which is not the case with other types. All tower levels are held automatically either by control of feed to the tower or by actuation of an automatic valve on the discharge from the towers. Top of tower temperatures, in general, are held by temperature control. Important temperatures are on recording instruments, with intermediate temperatures available on indicating potentiometers. A Philco-phone system provides ready communication throughout. All of the main flows are discharged to a centralized manifold where the automatic valves are housed from weather, and which is so located in proximity to the control room that hand control can be resorted to should any instrument be out of order.

Instrumentation

It is doubtful if the individual efforts of a number of operators could ever be coordinated to give the exacting control obtained in the two combination units. The units are equipped with more than 100 diaphragm motor valves ranging in size from one-half inch to 10 inches. In addition to the above conventional air actuated types of valves, there are 14 which are operated by explosion proof reversible motors through gear trains and two which are operated by Selsyn motors through gear trains. The Selsyn motor control was chosen for the large heater release valves because it allows the operator to "feel" small changes in the valve setting. In the Selsyn system the movement or turning of the transmitting motor by a hand-wheel mounted on the instrument board is immediately reflected by an identical movement of the receiving motor to which the valve stem is connected through gear trains. The operator "feels" the valve open or close in much the same manner as he would with manual control. The electrical system



High temperature valves and bends.



As nearly automatic as a plant can be. Control by Mason-Neilan.

Motor operated valves.

merely acts as a conveyor of the energy remotely applied.

Most of the air actuated valves are operated by recording flow controllers, however, there are some which are operated by level recording pressure and potentiometer or bulb type recording temperature controllers. The Brown and Leeds & Northrup instruments are mounted on a board approximately eight feet high and 83 feet long. The major instruments are mounted in two rows throughout the length of the board, with a third row (above the other two) being used for pressure gauges and other instruments not requiring frequent adjustment. There are 137 instruments on the board. These include 43 flow meters, 28 flow controllers, 26 pressure gauges, 22 recording potentiometers, eight recording potentiometer controllers, four recording pressure controllers, four recording pressure gauges, and two indicating potentiometers. Each of the indicating potentiometers is coupled with a switch panel having 96 points. The number of the recording instruments required was materially reduced by adding 75 extra pens to the instruments for recording related pressures or levels.

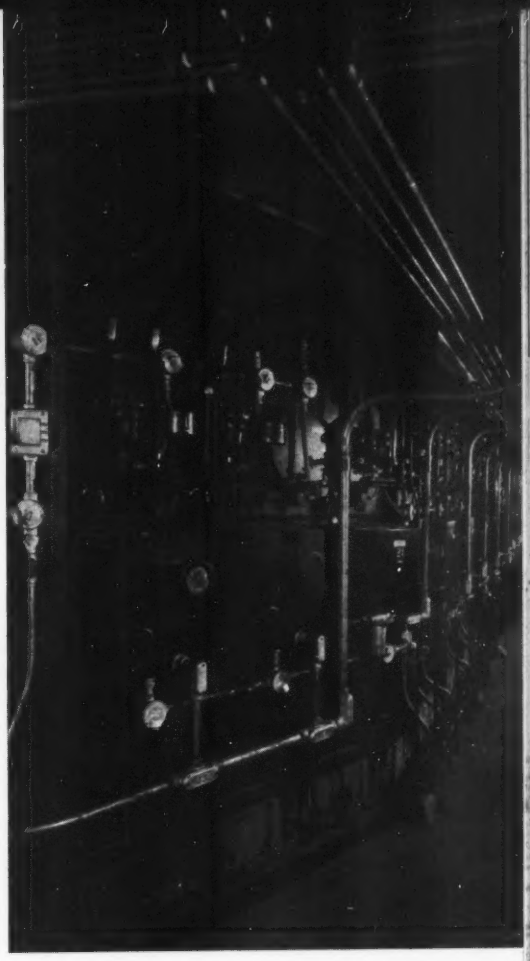
Levels in 14 towers and six receivers are indicated on the board by the simple expedient of recording the air pressures which the level control pilots exert on the diaphragms of the liquid level controlled motor operated valves. This pressure is readily translated into feet of liquid by the operators. The control room presents an impressive picture with its battery of well-lighted instruments mounted on black in contrast to the white tile walls. The heavy vegetable cork floor covering adds to the comfort of the operators.

Ample space was allowed behind the instrument board to permit easy access to the instruments. This space was equipped with exhaust fans so that any leaks encountered in instrument piping would not cause fumes to enter the control room. The fans draw the air from the control room through openings in the instrument panel.

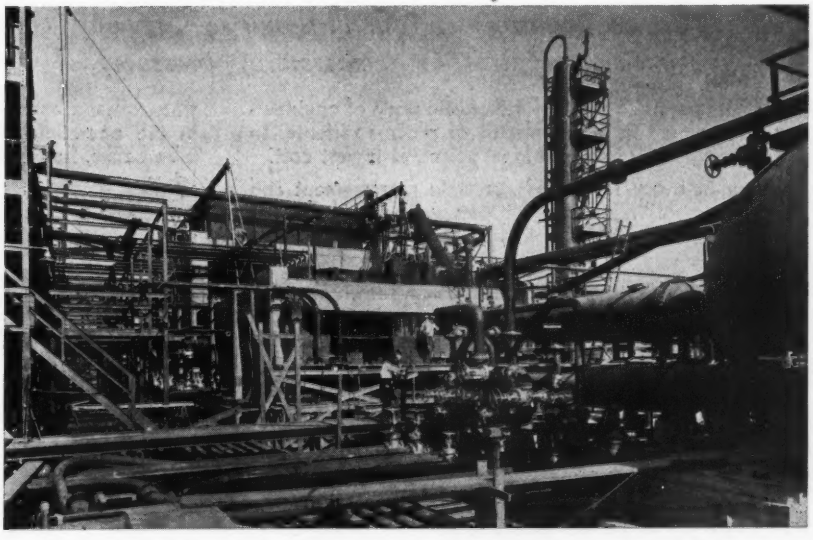
In bringing-up a new unit there is usually a certain amount of confusion about the location of any one of the numerous control valves. In order to eliminate this condition, a system was devised wherein each valve was assigned a number with respect to its location. These numbers appear adjacent to the instrument controlling the valve, as well as on directories located about the units. For example, on each walkway level, around the bubble cap towers, there is a directory listing the numbers of the motor operated valves at that elevation.

Pumps for the combination units are all motor driven centrifugals with centrifugal steam driven stand-bys, the stand-by pumps being common to both stills. The exceptions to this general pump arrangement are: 1. Heater feed pumps (one per unit) which are motor driven with a steam tandem drive which automatically cuts in in case of power failure. 2. Centrifugal tar pump spares which are twin simplex. These pumps also serve for the bring-over and pumping out of the unit.

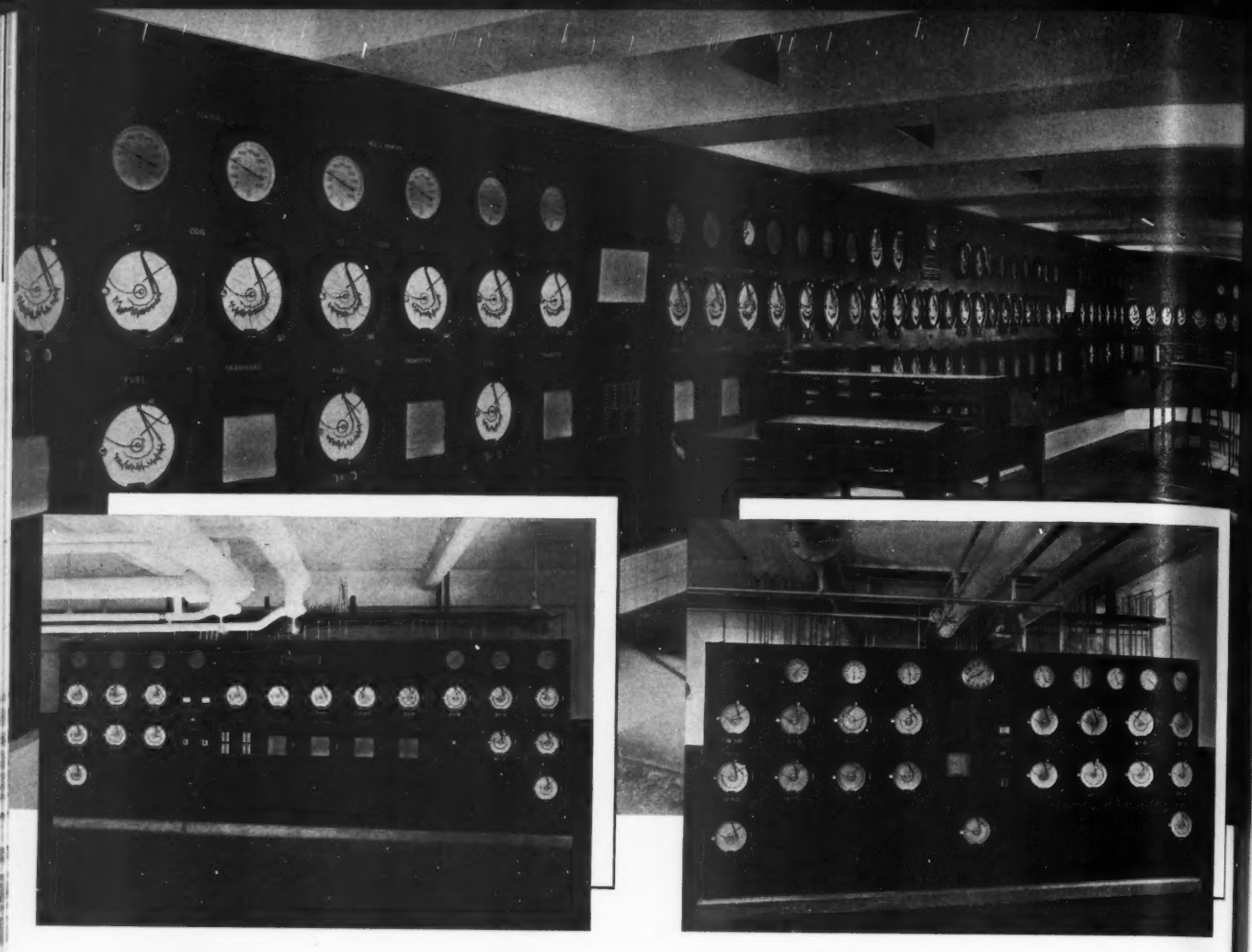
The heater feed pumps have spare barrels. The pump rooms are equipped with overhead monorails and other facilities for quick changing to the spare should the pump fail. Also, the crude and reduced crude feed pumps are equipped with tandem steam driven turbines, in addition to their common steam stand-by, which automatically cut in in case of power failure, thus protecting the heater flows. The exchangers are arranged in a convenient bank and are equipped with overhead hoists for handling heads on both ends of the exchangers, as well as the tube bundles. The submerged condensing sections and aftercoolers are also equipped with overhead trolley beams for



Piping behind the control board.



Trench between receiving house and columns, west end.



Again! it's BROWN CONTROL *139 INSTRUMENTS*

Brown Engineers and C. F. Braun & Company cooperate in providing precision control of temperature, pressure, flow and liquid level.

The photographs above, tell a dramatic story of engineering achievement in the regulation of process variables to obtain maximum yield and high octane at lowest cost.

Modern in every respect—"Accurate measurement and positive control" might well be the watchword of the new Refinery of the Richfield Oil Corporation at Watson, California.

The centralized instrument control boards, shown above—the largest of which is 83 feet long—include 139 Brown Instruments consisting of 115 Brown Flow Recorders and Controllers . . . 7 Potentiometers . . . 4 Thermometers . . . 11 Pressure Gauges . . . 2 Liquid Level Controllers.

Throughout the oil industry, the world over, Brown Instruments have earned the preference of exacting engineers who demand accurate measurement and positive control in the operation of stabilizer reboilers, polymer units, tube banks, fractionating towers, case heads, gas accumulators, separators, stabilizer reflux, yield separators, topping units, etc.

We'll be glad to tell you how Brown Instruments can be used to advantage in your plant. Write THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Co.*, 4439 Wayne Avenue, Philadelphia, Pa. Offices in all principal cities. Toronto, Canada: 117 Peter Street — Amsterdam-C, Holland: Wijdesteeg4 — London, England: 70 St. Thomas' Street, S.E.1 — Stockholm-16, Sweden: Nybrokajen 7.

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Power distribution and switching room for combination units.

removing this equipment to ground level for repairs.

To meet corrosion, all heater piping, tubes, and fittings are of chrome-moly alloy. All process piping at 600° F. or above is also of chrome alloy. Sections of the cracking towers operating above 600° F. are lined with chrome alloy strips welded on, and are equipped with alloy bubble caps and trays. High temperature exchangers are similarly protected and in addition are equipped with alloy tube bundles. All piping subject to corrosion is protected by the deFlorez safety drilling method. Weep holes, one-eighth inch, are drilled to a depth equivalent to the allowable or retirement pipe thickness, and a half-inch pipe welded over the hole projects through the insulation to provide an immediate indication of severe wear or corrosion inside the piping.

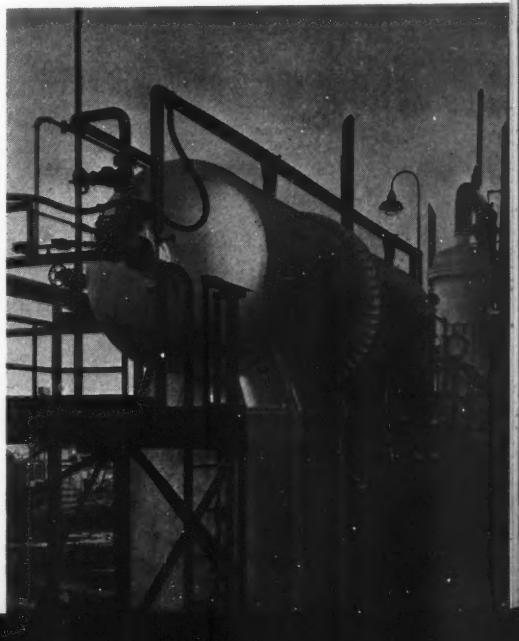
The tubes in all heaters are equipped with metal temperature couples for guidance in firing and heat distribution. Careful inspections are made at the end of each run. Tubes are calibrated by means of an electrically indicating tube caliper dropped through the tube. Fabricated piping is so constructed that inspection can be readily made of any section or fitting for corrosion or cleanliness. All bubble trays and baffles are furnished with individual manholes for inspection and cleaning. The vapor lines are continually fed with aqueous ammonia, piped from common centralized refinery supply, in sufficient quantity to maintain 7-8 pH value on the overhead streams.

Heat exchange utilized on the units is in keeping with good engineering practice. Approximately 33% of the total heat required is supplied by exchange. Efficiency of the deFlorez heaters, approaching 80%, in addition to the waste heat exchange, gives extremely low overall fuel figures. Recent tests show as low as 200,000 B.t.u.'s per barrel of feed. In addition, each unit furnishes heat for casinghead recovery from gas and stabilization of its own distillate.

The 400° F. endpoint distillate yields range from 32% to 40% depending upon the gravity of the reduced crude charged to the cracking cycle and viscosity of the fuel produced. Fuel viscosities range from 90 vis. at 122 SF to 150 SF maximum. Conversion rates on the deFlorez heaters, approaching 20% crack per pass, have been realized with no coking of the heaters.

Producing the Finished Gasoline

In addition to the two combination units, the Richfield construction program included the installation of cracked distillate finishing units. Such units provide for the debutanization of the raw distillate for the purpose of producing a bottoms product most adaptable for subsequent treating; the stabilization of the light ends of the pressure distillate to furnish poly charging stock consisting of



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butanes and lighter; the polymerization of such gaseous hydrocarbons into poly gasoline, and the caustic washing of all stabilized light ends for mercaptan sulphur removal.

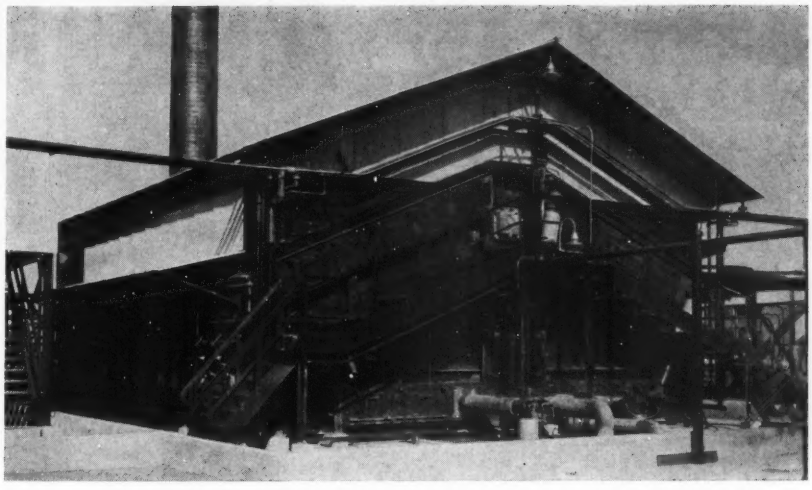
Combination Unit Yields

Typical yields on the type of reduced crudes available to date are as follows:

Type of Reduced Crude:	Ventura Reduced Crude	Wilmington Reduced Crude
400° F. Endpoint Cracked Distillate	38.5%	35.1%
Dry Gas (fuel equivalent @ 1,300 B.t.u.)	4.5%	4.2%
Cracked Tar	61.5%	65.7%
Vis. at 122 SF	135	100

The raw cracked distillate as produced on the combination units includes all desirable light ends obtained by wet gas absorption at the combination units. It has an ASTM endpoint of 400° F. This distillate is fed directly to the debutanizer unit, which operates at about 100 pounds gauge pressure. The debutanizer is of the conventional type. By flow, temperature, and pressure controlled distillation and fractionation, a bottoms product having an ASTM initial boiling point of about 225° F. is produced. This bottoms product, which is relatively high in sulphur content, is routed through treating and rerun operation for finished gasoline conditioning.

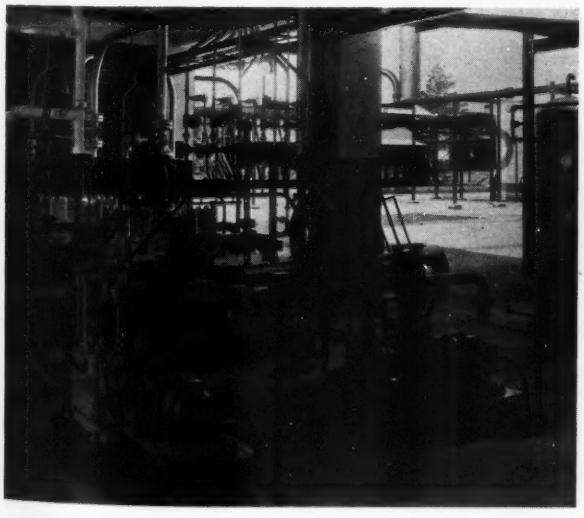
The debutanizer liquid overhead, which contains all of the butanes and lighter from the cracking operation, is fed to the stabilizer. This unit is also of the conventional type and operates at 200 pounds gauge pressure. Distillation and fractionation, obtained by careful flow, temperature, and pressure control is carried on to produce a butane-free bottoms product known as casinghead and a gaseous overhead which contains all of the butylenes and propylenes. Heat required for this stabilization is furnished by a circulating heat medium from combination unit source, and from high pressure steam.

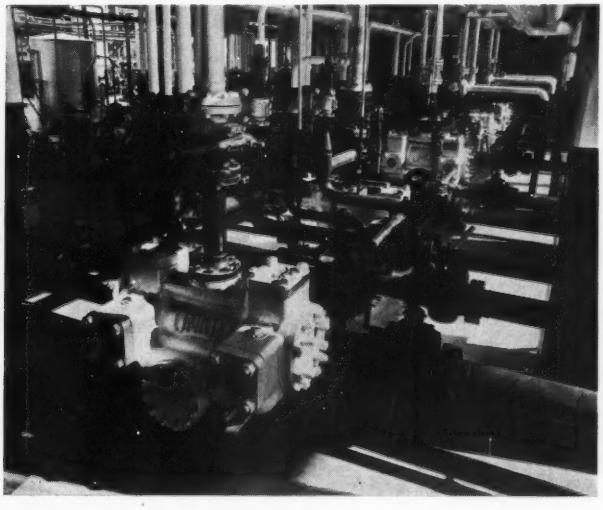


Alcorn recently stepped ahead with a new type of heater.

The stabilizer release gas, because of its high hydrogen sulphide content of approximately 5%, must be processed in a gas treating system before it passes on to the poly plant. This is done to avoid the production of a poly gasoline high in fixed sulphur content. The tri-potassium phosphate process (Shell Development Co.), operating at 200 pounds gauge pressure and about 180° F., is used for this purpose. Better than 90% of the hydrogen sulphide present in the gas is removed by this process.

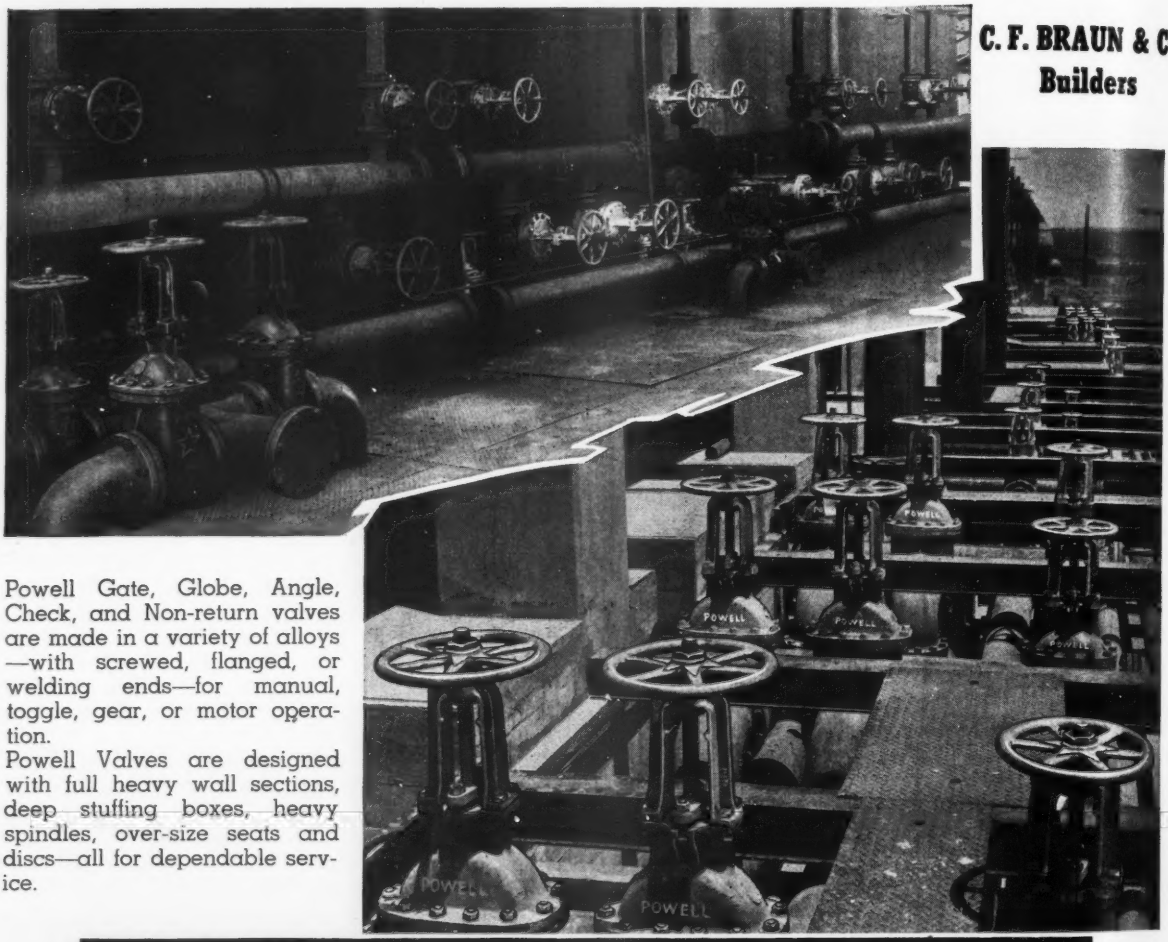
Briefly (the tri-potassium phosphate process is described at length elsewhere in this issue), the gas treating unit consists of an H_2S absorber and a solution reclaiming system. The gas passes upward through the absorber, counter-current to two concentrations of tri-potassium phosphate solution. The use of two concentrations of solution enhances the efficiency of the operation. The foul solution is run from the bottom of the absorber to the reclaiming system where it is heated at substantially atmospheric pressure to drive all hydrogen sulphide overhead. Indirect, high pressure steam is used. The hot reclaimed solution is routed through a surge tank and foul solution heat exchange to the absorber. Part of the reclaimed solution is diluted for top absorber introduction, and the balance is introduced directly to a lower absorber entry. The overhead hydrogen sulphide and steam mixture is partially dehydrated and then disposed of by burning in a refinery furnace. The condensed steam is utilized for dilution of reclaimed solution.





These Hills—McCanna and Union Pumps have no quitting time.

• IN THE NEW RICHFIELD REFINERY •



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The treated gas is passed through a dehydrator system which has been installed to prevent any possible phosphate solution carry-over to the poly plant catalyst towers. The hydrocarbon release gas from the H_2S unit dehydrator, containing approximately 35% higher olefins, now passes into the catalytic polymerization equipment where the propylenes and butylenes in the gas are converted to polymer gasoline.

Poly Plant Equipment Services

The poly plant equipment can be classified under two services: one section of the plant is used for producing the polymer gasoline and stabilizing it to a desired vapor pressure, whereas the other section is used to reactivate the catalyst.

Equipment used for polymerization and stabilization consists of a process heater, five catalyst towers, water separator, raw poly condenser and receiver, and polymer stabilizer equipment. This stabilizing equipment is of the conventional type. Equipment used for reactivation of the catalyst includes a flue gas generator, flue gas scrubber, and super-heater. The latter piece of equipment serves as a superheater for both the flue gas during burning of the catalyst and for steam during the hydration of the catalyst.

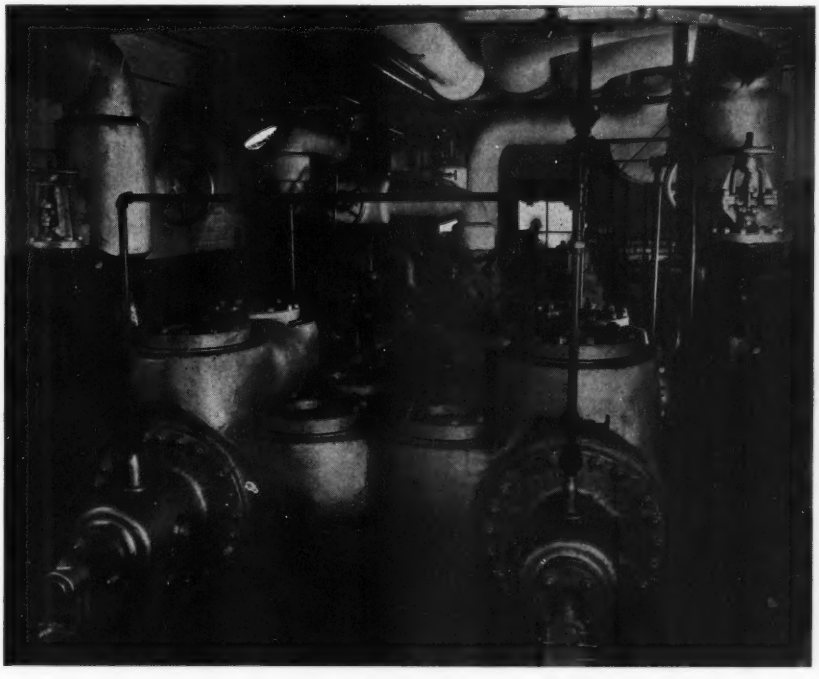
Polymerization of Cracked Gas

The polymerization of cracked gas employs process heater outlet temperatures ranging from 350° to 425° F., maximum catalyst temperature of 500° F., and operating pressures ranging from 160 to 200 pounds gauge. The products of polymerization are processed in a stabilizer operating at 200 pounds gauge pressure and controlled similarly to the other stabilizer described above. The overhead is a gaseous product and is released into the refinery fuel system.

Each of the catalyst towers is periodically taken out of polymerization service for reactivation. This is accomplished by first passing flue gas obtained by perfect combustion at 30 pounds gauge pressure, dehydrated by cooling and preheated to 700° F., through the catalyst together with carefully controlled small successive increments of air for removal of carbonaceous matter by burning. When this operation is complete, superheated steam is passed through the catalyst bed for the purpose of properly conditioning the catalyst with respect to moisture content.

Polymer gasoline of the desired vapor pressure and cracked casinghead are mixed as made and thence passed through the caustic wash unit. This operation serves for the removal of about 75% of the mercaptans present, and thereby materially decreases the load on the gasoline sweetening system.

The combined products are intimately mixed with about an equal volume of dilute caustic solution and the mixture



Above, Westinghouse motors and Dayton-Dowd pumps handle the water problem. Below, the big Union hot oil pump is the heart of the refinery.

Two 250 hp. and two 400 hp. Westinghouse Synchronous motors drive water transfer pumps for cooling.

C. F. Braun and Company, General Contractors.

IN RICHFIELD'S *New Refinery*

The immediate success of Richfield's new 50,000 barrel refinery at Watson, California was due to the close co-operation among owners, contractors and suppliers. For Westinghouse, this working partnership idea is an everyday affair. Whether the job calls for a complete electrification, or a single safety switch, you will find Westinghouse engineers co-operating with representatives of the petroleum industry, their engineers, contractors and suppliers —to deliver and apply power dependably and economically.

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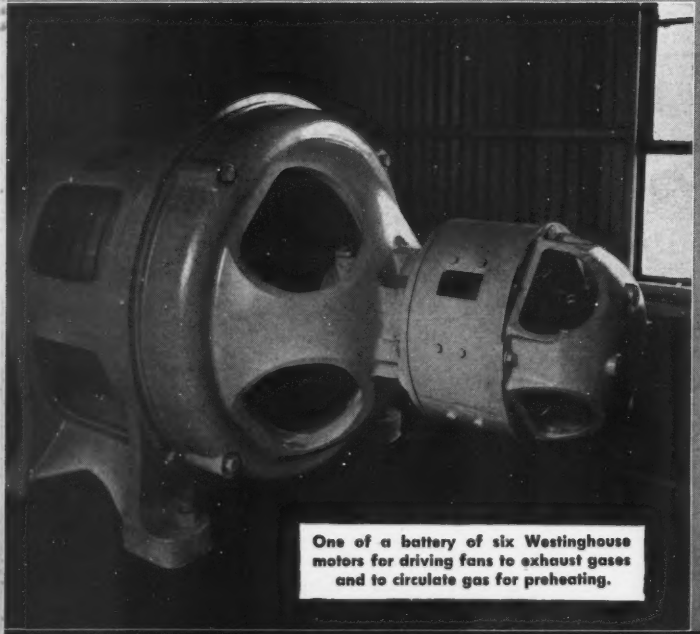
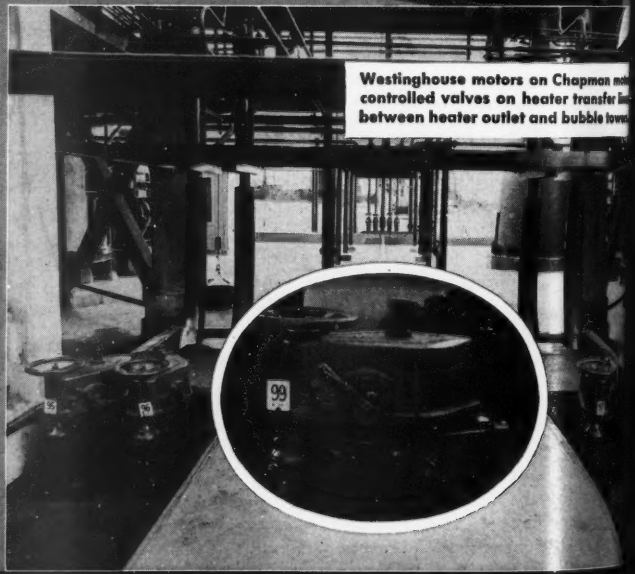
Westinghouse AB Breakers protecting various electrical circuits.



One of a battery of six Westinghouse motors for driving fans to exhaust gases and to circulate gas for preheating.



Westinghouse motors on Chapman mot... controlled valves on heater transfer li... between heater outlet and bubble tow...

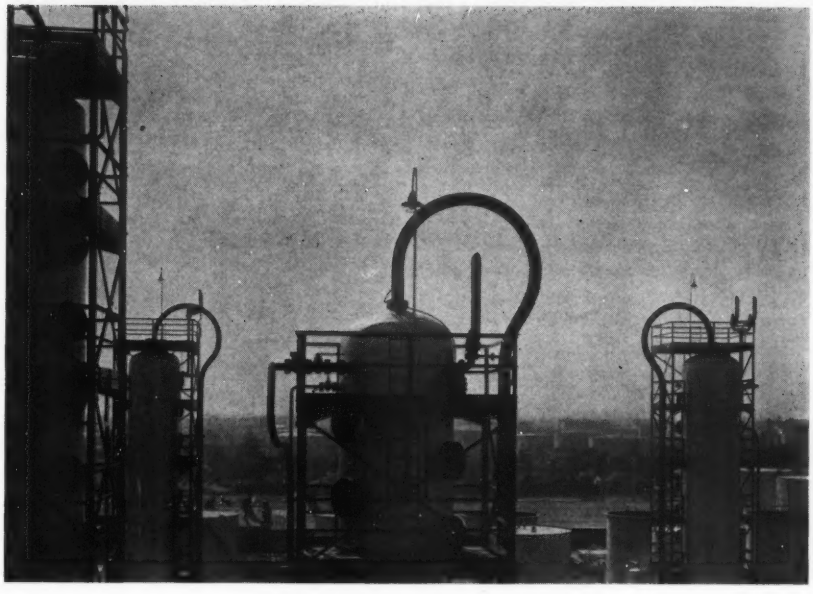
Westinghouse

ELECTRICAL PARTNER OF THE PETROLEUM INDUSTRY

settled in a separator. The gasoline from this separator is routed directly to the finishing operation. The spent caustic solution is steam stripped and returned for re-use after cooling. Mercaptans removed by stripping are disposed of by burning. Debutanizer bottoms, after treating and rerunning, plus the caustic treated casinghead and poly stock, are blended and subjected to a final sweetening operation which results in a finished gasoline.

In designing the $5,000,000 project no effort was spared in attempting to solve problems dealing with safety for the operators and protection for the equipment. The Sinclair inspection staff covered the physical inspection of all pressure vessels, heat exchangers, pumps, and piping which were used in the new plant. The inspection procedure included a thorough check on raw materials, fabrication, and finishing of all equipment while in the vendors' shops. The pressure vessels and exchanger shells are of welded construction. They were built in strict conformity to the API-ASME code for unfired pressure vessels. In addition to code requirements, many X-rays (Braun is equipped to X-ray inspect the heaviest welds attempted) were made of welded joints as a check on the quality of welding.

In addition to the normal safety valves installed on pressure vessels, small pop valves are installed on each group of exchangers where it is possible to close them in and set up pressure stresses due to expansion of the closed-in-oil. Considerable corrosion and erosion occurs in any cracking system, so the deFlorez safety drilling method was applied in the pyrolytic set-up as a safeguard. A large percentage of the hottest and highest pressure piping is located in trenches, below grade. This is done partly for fire protection and partly as an added protection against earthquakes. These trenches are covered with steel plate and divided into relatively small sections with fire walls to prevent the spreading of a flash which may occur in some section of the trench. The refinery was already equipped with adequate storage tanks and pumping equipment for foam solutions. The solution lines are extended to form a loop about the new units. From this loop, separate solution lines are run to mixing heads located in each section of the pipe trench. In addition, foam hose stations are located at strategic points about the units. In the pump-rooms, steam smothering lines with many outlets and remote control of steam introduction are installed. Besides these main fire fighting installations, many steam hoses and numerous small CO_2 extinguishers are installed about the units.

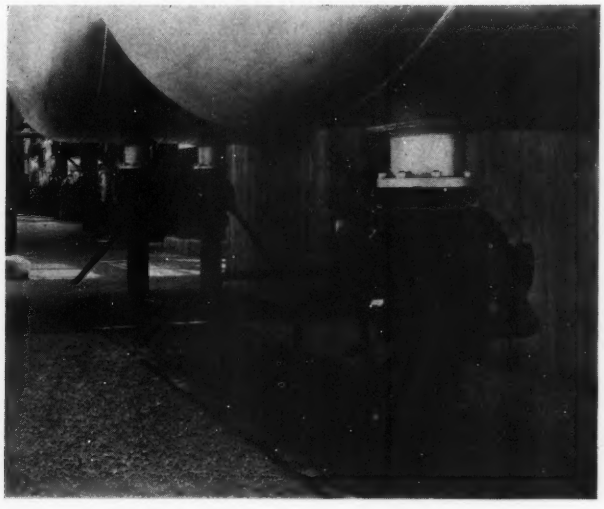


Overhead streams—Crosby relief valves.

On the top of the deFlorez heaters a continuous walkway with insulated floor plates and insulated sides about five feet high, runs the entire length of the line of heaters. The walkway connects with enclosed stairwells located at both ends of and at the center of the row of heaters, thus providing safe exit to ground level.

Ample structural steel work is built around the fractionating columns and so arranged that all valves are readily accessible from a platform so that a man does not have to hang out over space while packing or operating a valve. In arranging this steel work, more than one exit is accessible from any given point. There are two stairwells extending from

At the top and bottom, left and right, respectively, of the poly plant, these Merco-Nordstrom Valves handle the high octane element.



top to bottom of the tower steel structure. In addition to these stairwells, there are two walkways connecting the top walkway around the towers to the top heater walk, and scattered throughout the steel work are several ladders by which men can pass to various walkway elevations to escape any hazardous condition.

Pipe lines are in several instances carried by a spring suspension where temperature conditions will not permit solid supports. These spring supports are all enclosed in fire protective housings so that supports will not fall in case of fire. Fire steam and steaming-out steam to the heaters are all remotely controlled. Steam nozzles are scattered throughout the header compartments on all heaters for smothering header fires. Controls for header compartment steam are located reasonably close to the heaters so that the effect of steam introduction can be observed. Smothering steam into the body of the heaters and steaming-out steam for the heater coils have their control points located at a greater distance from the heater so that they are accessible under almost any conceivable hazardous condition.

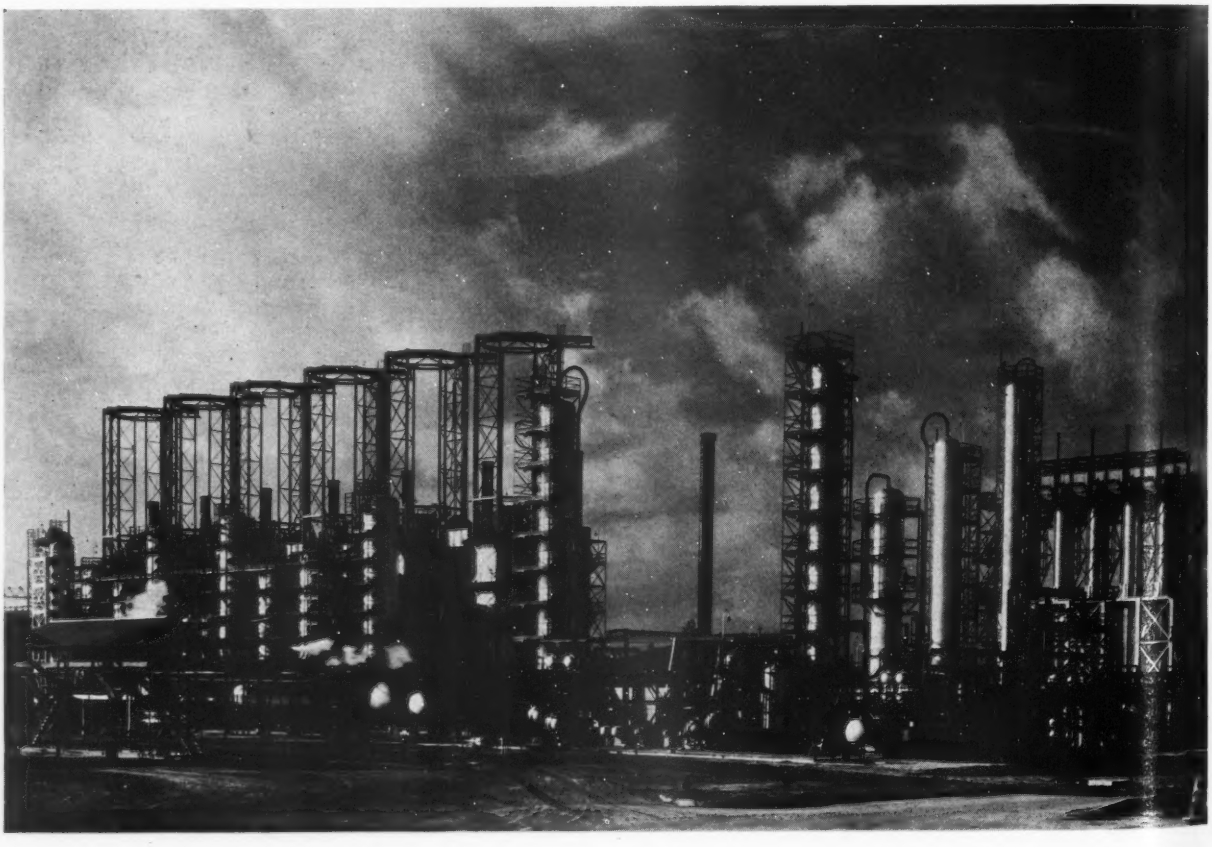
A so-called "fraid system" is installed on each unit. This consists of a system of piping tied into the heater feed lines in such a manner that the opening of one valve will dump the contents of all cracking heaters on each unit through its separate cooler to tankage. Crude and reduced crude heater coils can also be emptied through this same system. High pressure steam lines equipped with check valves tie into the opposite end of the heater coils from the "fraid" connection. When the "fraid" valve is opened and heater coil pressure drops below steam line pressure, steam is turned into these lines to blow all oil and vapors from the heaters. These "fraid" coolers and dumping manifolds are remote from other equipment.

The smaller pumps handling hot oil for both units are installed in a single large room with one long side open. As this does not provide sufficient ventilation when considering the temperature of the oils being handled, two blowers are installed, taking suction at several points near the ceiling in the back part of the room. The blower suction ducts are equipped with dampers held open by fusible links. In addition, the blower motor is equipped with a remote stop button so that the blower may be shut down immediately in case of a fire.

The steam turbines are equipped with an automatic steam valve which opens at approximately 150 RPM below the normal motor speed. The emergency hook-up results in a decrease in pump head and capacity on power failure, but does maintain a sufficient flow of oil through the heaters to keep the stills on stream through a brief power interruption, and will permit a gradual bring-down of the stills in case the power interruption is long enough to force a shut-down.

Since water supply pumps, as well as the majority of the oil pumps, are electrically driven, large condenser boxes with submerged coils are used for overhead streams and similar boxes are used for tar and pump-out service. The volume of water in these boxes is sufficient to permit several minutes operation without unreasonably high steam temperatures, at least allowing ample time to bring the units down in case of a complete water supply failure.

The air for actuation of instrument controlled motor valves is supplied by a small motor driven compressor. In order to protect these instruments, there is a cross connection to the yard air supply which is from steam driven compressors. This air is automatically cut in on failure of regular instrument air supply. Motor valve by-passes are equipped with globe valves usually one line size larger than the motor valve so that reasonable hand



Another view of refinery giving a closeup, right, of the poly and hydrogen sulphide removal units.

control can be had in case of instrument failure.

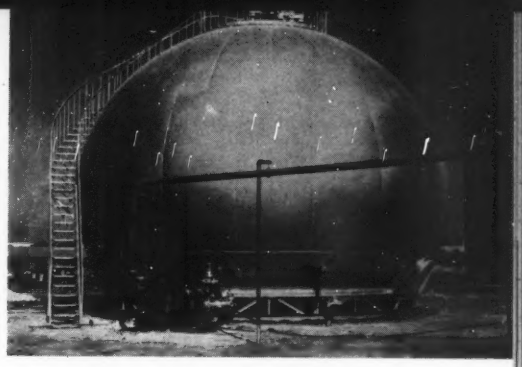
Certain lighting circuits throughout the unit are tied into a common main circuit, and this circuit also carries all instruments and electrically operated valves. In case of power failure this entire group is automatically cut over to an emergency steam turbine driven generator which starts up on power failure. Several motors on fans and water pumps are installed at quite a distance from the control room. Since it is necessary for the operators to know instantly when there is a failure, tell-tale lights are installed on the instrument board to indicate that the motors are in operation.

Due to the high temperature of the oils being handled, the majority of pumps are equipped with water cooled stuffing boxes, and in some cases with water cooled bearings. This water supply is tied into the fire water system which is maintained at pressure by a steam turbine driven centrifugal pump, in addition to the regular cooling water supply system. This is hooked up to cut it automatically on pressure drop of regular service water. Since these stills operate on crude containing relatively high percentage of sulphur compounds, every effort is made to prevent liberation of hydrogen sulphide bearing vapors. Even vent gases from atmospheric receivers and vacuum jets are collected by lines which discharge this H_2S laden gas to the furnaces. In addition to these precautions, several gas masks are located around the units for use in areas where vapors might be present.

Electrical Equipment

Power rates in the area were sufficiently low to make the use of electric power more desirable than the use of steam, since the use of steam for full load would require extensive additions to the existing boiler house at Watson. The old transformers and switching gear had a capacity of only 3,000 KW, therefore, considerable rehabilitation and expansion in size of the main Watson refinery substation was necessary in order to handle potential new requirements of 9,000 KW.

The substation was rebuilt and nine 1,000 KW transformers were installed by the Southern California Edison Co. The utility company furnishes current to the new substation through two feeders, each supplied from an independent source. Either feeder can supply the whole plant load in case of a power interruption in the other. To secure maximum protection in case of a power failure in the incoming feeders, automatic switches actuated by reverse power relays have been installed, ahead of the transformer bank,



Horton spheroids for light ends.

which disconnect the faulty feeder without interrupting the plant supply. The usefulness of this arrangement was recently demonstrated when several power failures occurred in the Los Angeles district with no interruption being experienced by the refinery.

The 11,000 volt current entering the plant is reduced to 2,300 volts through the nine 1,000 KW transformers. The 2,300 volt feeders from the transformers are equipped with current limiting reactors. These reduce the fault current on all new switch gear in the main substation to approximately 50,000 KVA. This fault current is considerably lower than that resulting from the transformer installation. So that existing switching gear could remain in service, additional reactors were installed which further reduced the fault current from 50,000 KVA

Stainless steel welding electrodes prepared especially for the oil industry

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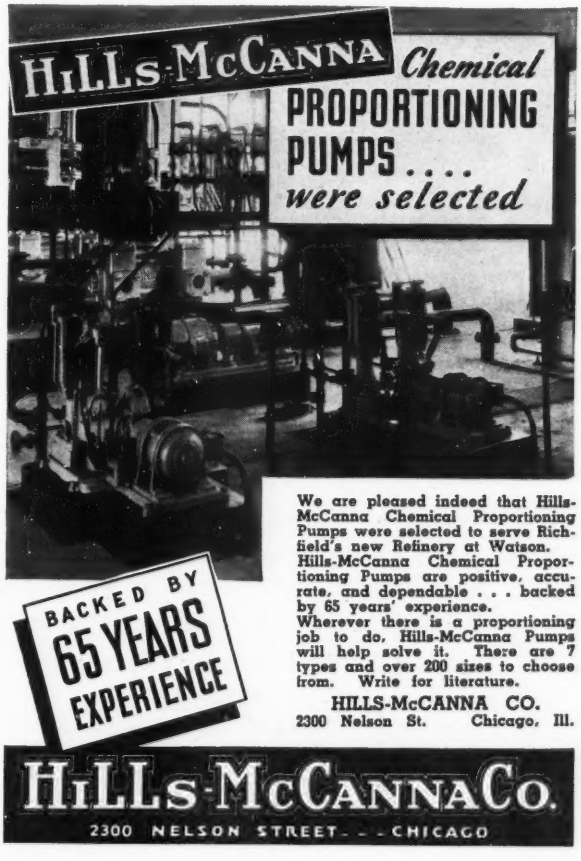

We are pleased indeed that Hills-McCanna Chemical Proportioning Pumps were selected to serve Richfield's new Refinery at Watson. Hills-McCanna Chemical Proportioning Pumps are positive, accurate, and dependable . . . backed by 65 years' experience. Wherever there is a proportioning job to do, Hills-McCanna Pumps will help solve it. There are 7 types and over 200 sizes to choose from. Write for literature.

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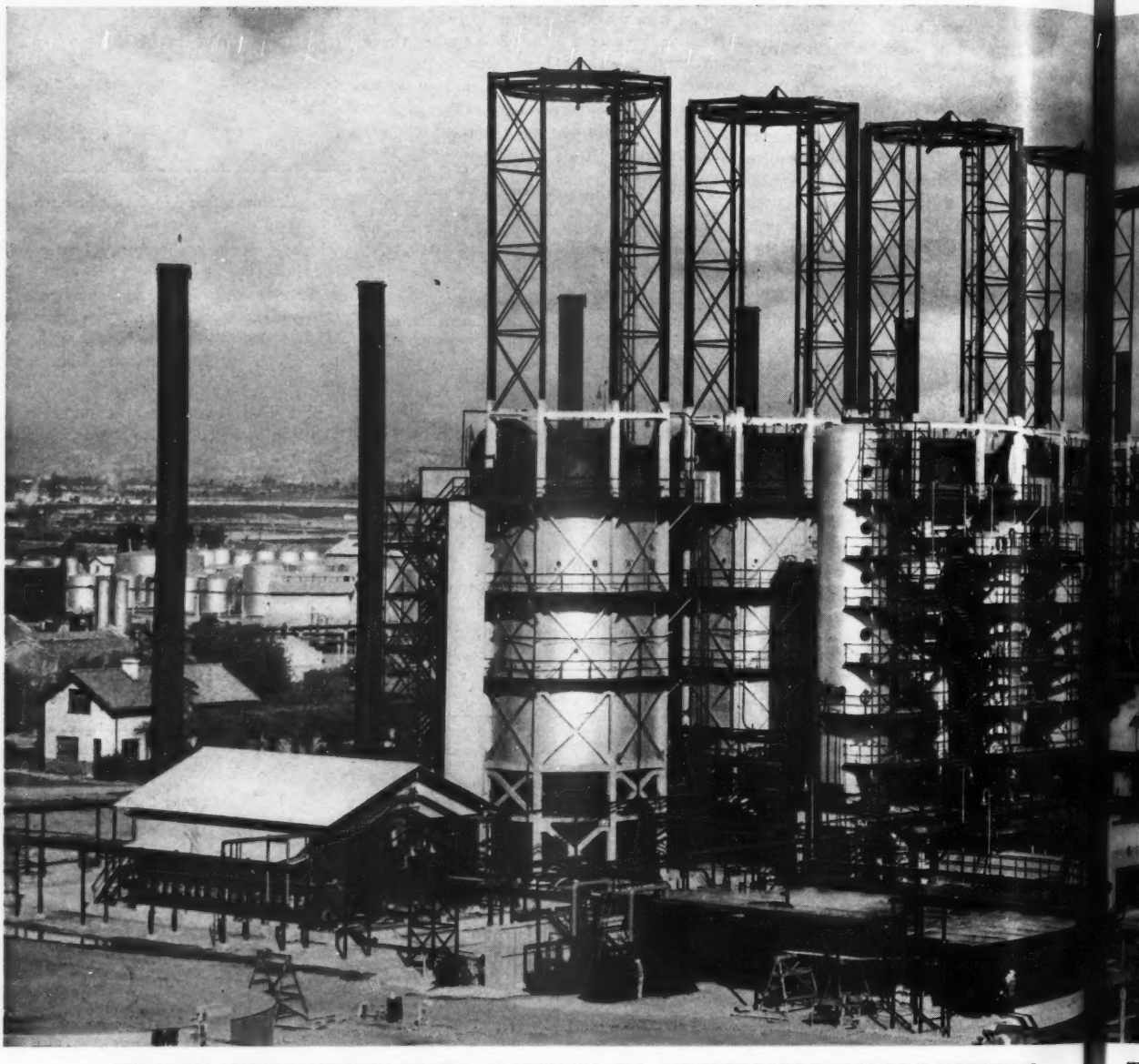
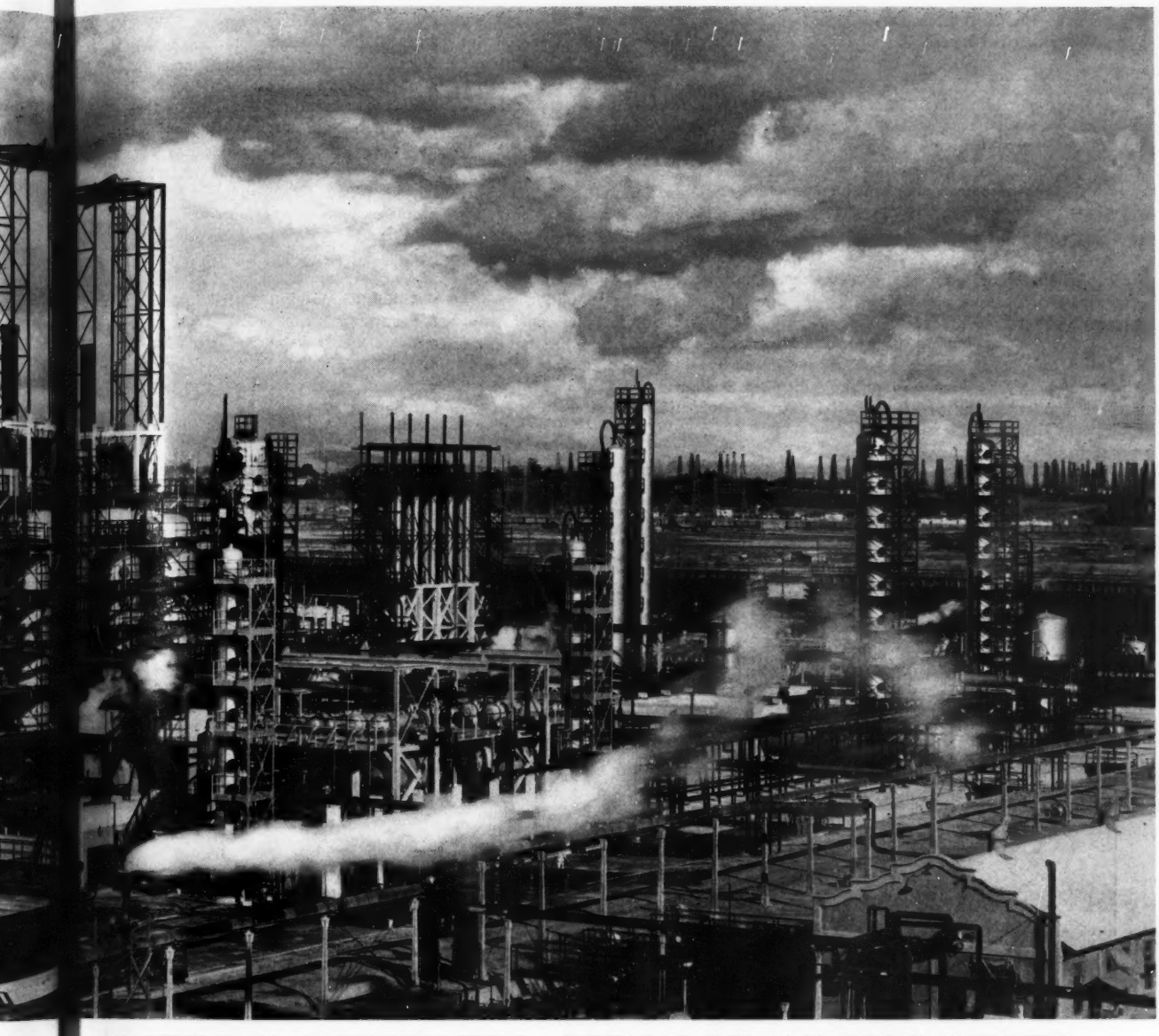


THE 1938 INSTALLATION AT THE RICHFIELD OIL CORPORATION WATSON REFINERY –

This immense installation is one of the largest refinery projects executed on a single contract, —some $5,000,000. The main-plant is a Double Combination Unit for combined topping and cracking,—two units operate in parallel. The total charge is 50,000 barrels per day.

The supplementary units, installed concurrently, take care of Debutanization, Stabilization, Hydrogen-Sulphide Removal, Dehydration, Depropanization, Caustic-Wash, Catalytic Polymerization. And the new refinery water-system cools and circulates 24,000 GPM—thirty-five million gallons per day. All of this work was built by Braun.



TWO MILES FROM LOS ANGELES HARBOR — SIGNAL HILL FIELD IN THE RIGHT BACKGROUND

Contrary to the common practice of doing much of the work in the field, this plant was largely shop-fabricated. All of the major refining equipment and some 10,000 complete units of piping and accessories, were manufactured and tested at the Braun plant and shipped to the site ready for field-assembly. The field-crew averaged less than 250 men.

Full-time capacity operation, followed immediately after construction. Both combination-units, and all the supplementary units, remained onstream, continuously from the start, for initial runs of 30 days—and then the shutdowns were voluntary, for the purpose of inspection. There was not a single forced shutdown.

C. F. BRAUN & CO.

ENGINEERS · MANUFACTURERS · CONSTRUCTORS
ALHAMBRA, CALIFORNIA

to 15,000 KVA on all old equipment. The use of these current limiting reactors greatly reduced the cost of modernizing the refinery's electrical layout.

First of Kind on Coast

It is understood that this is the first installation of automatic switching gear, reverse current current protection on feeders, and current limiting reactors in a refinery or any other industrial plant on the Pacific Coast.

The electric power for the new operating units is taken, after the first set of reactors, through four parallel feeders with overload protection on main substation switching gear and reverse power relay protection on switching gear located at the new units. In case of a fault in any one of the four feeders the other three can carry the plant load of 1,750 amperes for an indefinite period. Any two feeders can supply enough electrical energy to keep the units in operation provided that part of the pumping load has been transferred to the steam stand-by equipment. They will carry the load long enough to permit minor repairs or allow reasonable time to change over to steam driven equipment.

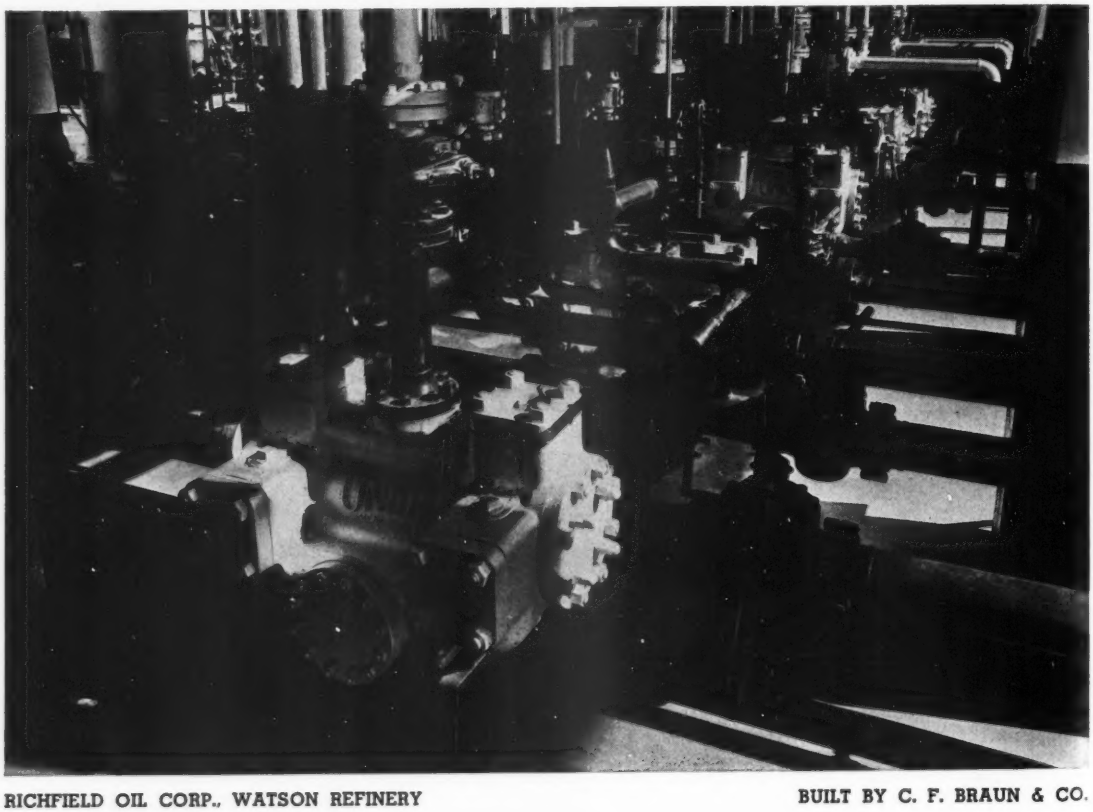
Explosion Proof Motors

At the combination units, debutanizer, stabilizer and polymerization plant, the electrical equipment is explosion-proof throughout. All motors ranging in size from one to 250 H.P. are of Class 1, Group D, construction to obtain underwriters' approval for installations in hazardous areas. All motors are equipped with across-the-line starters, oil immersed disconnects located in a concrete switch-room, and explosion-proof start-stop push buttons.

1,000 H.P. G-E Motors

In addition to the above motors, there are two 1,000 H.P., two-pole, 3,000 RPM across-the-line starting motors which are directly connected to the main heater feed pumps (one on each combination unit). These pumps circulate oil through the coils of the cracking heaters at rates up to 80,000 gallons per hour. Due to the limited facilities of the underwriters' laboratories, their approval on these large motors could not be obtained, however, these motors were built according to underwriters' specifications. To further make these motors as explosion-proof as possible, CO_2 is introduced into the motor housing, at pressure slightly above atmospheric, to keep explosive gases from entering. The gas is cooled by passing it around water-cooled coils in the motor housing.

These large motors are built with the



RICHFIELD OIL CORP., WATSON REFINERY — BUILT BY C. F. BRAUN & CO.

MIM-CLEARANCE PUMPS, Illustrated. Suitable for Handling Butane, Propane and Other Light End Products in Refinery Services.

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OTHER REFINERY PUMPS—"A Pump For Every Service", Centrifugal, Single and Multi-stage. Reciprocating, Steam and Power Driven.

UNION STEAM PUMP COMPANY
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P. L. Armstrong, Sales Engineer, Los Angeles, Calif.

shaft extending at each end. One end is coupled directly to the heater feed pump, and the other end is coupled to a steam stand-by turbine which automatically picks up the load at 150 R.P.M. below the electric motor speed and continues to drive the pump through the motor. Such an arrangement keeps the units on stream during short power interruptions.

The starters for these 1,000 H.P. motors are conventional oil immersed across-the-line magnetic starters of 50,000 KVA rating. Conventional start-stop push buttons also control these motors. No more effort is required to start these motors than is required to start the smallest motor on the units. These motors reach full speed from a dead start in three seconds and will idle, if disconnected from pump and stand-by turbine, for fifteen minutes after the power has been shut off. Each motor weighs about 16,000 pounds. Operation is unusually quiet as no windage noises, common to high speed induction motors, are present. These two motors are the first 1,000 H.P., two pole, across-the-line starting motors ever built, the first 1,000 H.P. motors to be put into use in a refinery in Southern California, and the only CO_2 cooled motors in the world. They were built by General Electric.

The main 3,000 c.f.m. and supplementary 750 c.f.m. compressors are operated by 600 H.P. and 100 H.P. synchronous unity power factor motors, respectively. The third compressor (instrument air), is operated by a 20 H.P. squirrel cage motor. The large motors are controlled by standard synchronous motor starters while the small motor has conventional magnetic starter with push button control.

There are two 400 H.P. and two 250 H.P., 80% power factor synchronous motors with directly connected exciters serving the plant which provides water for the new units. Operation is by push button control through synchronous starters and the oil immersed disconnect switches. The use of 80% power factor synchronous motors in non-hazardous areas has increased the overall plant power factor to almost unity. The power factor prior to the modernization of refinery equipment ranged between 82 and 85%.

Plant Water Supply

The water supply for the plant is secured from five wells varying in depth from 650 feet to 800 feet. These wells have ample capacity for makeup requirements under the new operating conditions. There are four cooling towers scattered throughout the refinery, two of which were relatively small and were not considered in the expansion program. No. 1 tower, which was in fair condition, was repaired, and a new hot water distributing system was added. New, larger, and more efficient pumps for both supply and return were installed. With these changes the capacity of this system was increased about 30%. As rebuilt it has ample capacity to satisfy that area of the refinery which includes revamped crude topping stills, the rebuilt rerun still, and the treating plant. No. 2 cooling tower was in worse condition. It was substantially doubled in length, and new decks and new distributing system were necessary on the old portion. This tower, when revamped, had over four times the capacity of the original tower. The rebuilt tower was assigned to the new combination units and their auxiliary equipment. With the increased capacity, new pumps and new pipe lines for both cold water and hot water return were required. Since a flood control channel and the refinery loading racks were between the cooling tower and the new units, this involved installing a large culvert under the tracks and special reinforcement of the lines to span the flood control channel.

Electricity Plays Major Role in Refinery

Many Innovations Feature Installation

By Coles Bason, Sales Engineer,
Ingersoll-Rand Co., Los Angeles, Calif.
and
R. E. Johnson, Sales Engineer,
General Electric Co., Los Angeles, Calif.

In any modern refinery, one of the most important and interesting phases of design is the successful application of proper equipment for the handling of the raw material and finished product through the manifold steps of refining processes involved. In designing the new Richfield Oil Corporation refinery unit at Watson, Calif., the Sinclair Refining Co. engineers and specialists, in cooperation with C. F. Braun & Co. of Alhambra, Calif., have obtained a most successful and outstanding installation of modern refinery transfer equipment. Of the total of 49 Ingersoll-Rand Co. pumps used in this installation, this article will attempt to cover only part of the motor-driven pumping units for the express purpose of indicating the duties of the units involved, and the way in which they fit into the scheme of making the finished product.

In a like manner will be described the General Electric Co. motors and control applied to these motor-driven pumps. All of these main-pump motors, except the 1000-h.p. units, are type KF 2-pole, 3-phase, 50-cycle, totally-enclosed, fan-cooled, Class 1, Group D construction, with full load speeds well above 2900 rpm. In all cases the pump speeds correspond to the direct connected motor speeds.

To enable the reader to more clearly visualize the location of each unit with respect to the rest of the refinery, a typical flow arrangement of a unit designed to handle crude, reduced crude, and gas oil has been included in Plate No. 1, and on this flow chart the location of the pumps and respective driving motors are shown by means of item numbers.

The process begins naturally with the introduction of crude to the system. Item P-4 shows the location of the three crude charge pumps. As shown on Plate No. 2, each of these is a four-inch two-stage centrifugal Type 4GT, designed to handle approximately 560 GPM of cold crude against a head of 275 lbs. Two of the three units are each driven by 250 hp. Type KF motors with double extended shafts for the application of stand-by steam turbines, and the third is direct connected to a 250 hp. steam turbine. These pumps discharge the cold crude through heat exchangers into the crude heater, and then into the flash column where it is separated into three products,—straight-run gasoline, a side stream of kerosene, and a residuum which will be refined further. The straight-run gasoline overhead is picked up by Item P-12 pumps and delivered to the line discharging into the straight-run gasoline storage tanks. These three pumps are each three-inch single-stage Type JVL centrifugals, two being driven by 15 hp. Type KF motors, and the third by a 15 hp. turbine.

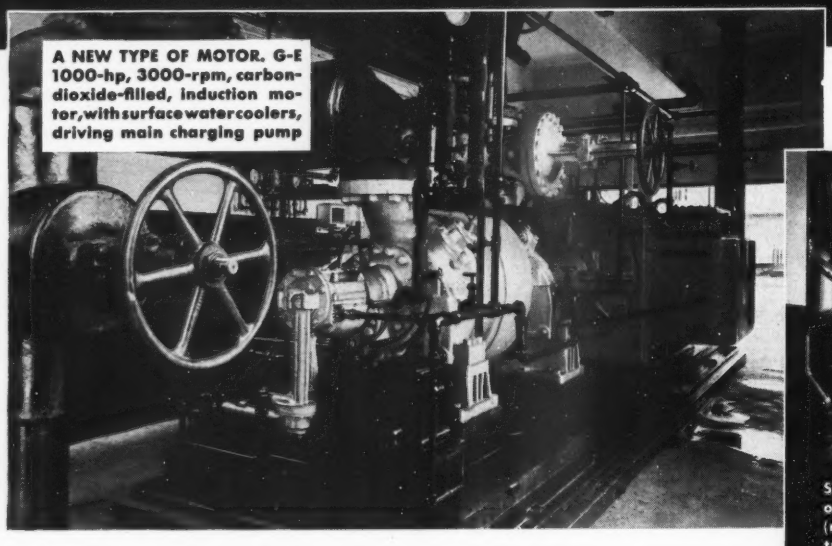
Item P-22 locates the flash column reflex pumps. These pumps, of which there are three, are each designed to handle approximately 490 GPM against a discharge pressure of 90 lbs. and at a temperature of 360 degrees. The units are all three-inch single-stage Type JVL centrifugals. Two of them are driven by 50 hp. Type KF motors, and the third by a 50 hp. turbine.

At this point, the reduced crude comes into the picture, and Item P-10 shows the location of the three cold reduced crude pumps. These equipments pictured in Plate No. 3 are all two-inch single-stage centrifugal pumps Type 2JVL, two of which are driven by 20 hp. Type KF motors, and the third of which is tur-

IN THE NEW RICHFIELD REFINERY

G-E Equipment Contributes to

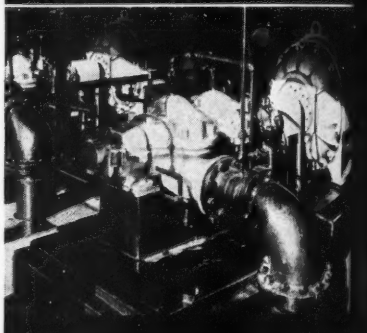
SAFETY ★ LOW COSTS ★ CONTINUOUS OPERATION



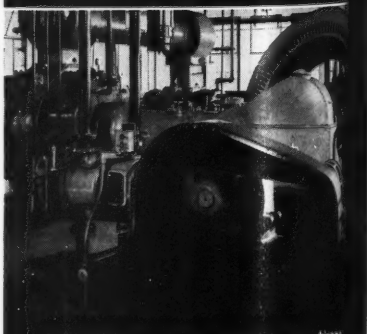
A NEW TYPE OF MOTOR. G-E 1000-hp, 3000-rpm, carbon-dioxide-filled, induction motor, with surface water coolers, driving main charging pump

F. BRAUN & CO.
ALHAMBRA, CALIF.
CONTRACTORS

Switch room, showing (left) G-E low-voltage oil-immersed, explosion-proof control and (right) G-E high-voltage, oil-immersed control (tanks painted black) and G-E D&W type oil fuse cutouts



G-E 250-hp totally enclosed, fan-cooled explosion-proof motors driving pumps in the cold-pump room



G-E 600-hp and 100-hp synchronous motors and G-E 20-hp induction motor driving compressors

THE new refinery of the Richfield Oil Corporation in Watson, California provides an excellent example of how G-E equipment and engineering can contribute to continuous, safe, and economical refinery operations.

Outstanding in the refinery are the two G-E 1000-hp, inert-gas-filled motors driving the main charging pumps. These motors are the first of their kind ever built. They were developed by G-E engineers after a preliminary study had shown that thousands of dollars could be saved with electric drive, provided large motors suitable for hazardous gas locations could be built.

Here are some of the types of G-E equipment installed in the new Richfield refinery:

1. The new-type, 1000-hp, inert-gas-filled, charging-pump motors
2. Current-limiting reactors that permit the use of circuit breakers of smaller interrupting capacity
3. D&W type oil fuse cutouts that are applied as disconnecting switches for the high-voltage starters in the switch room, providing short-circuit protection where required
4. Numerous explosion-proof motors, ranging from 15-hp to 250-hp in size
5. Synchronous motors on compressors that help maintain good power-factor and thus keep power costs down
6. High-voltage, oil-immersed control suitable for hazardous gas locations
7. Low-voltage, oil-immersed, explosion-proof control
8. Transformers

The numerous other types of G-E equipment in service there likewise reflect the resourcefulness of G-E engineering and are convincing evidence of the ability of General Electric to supply electric equipment that meets not only the ordinary but also special refinery requirements.

Our nearest representative will be glad to discuss *your* requirements with you. Get in touch with him at your convenience. General Electric, Schenectady, New York.

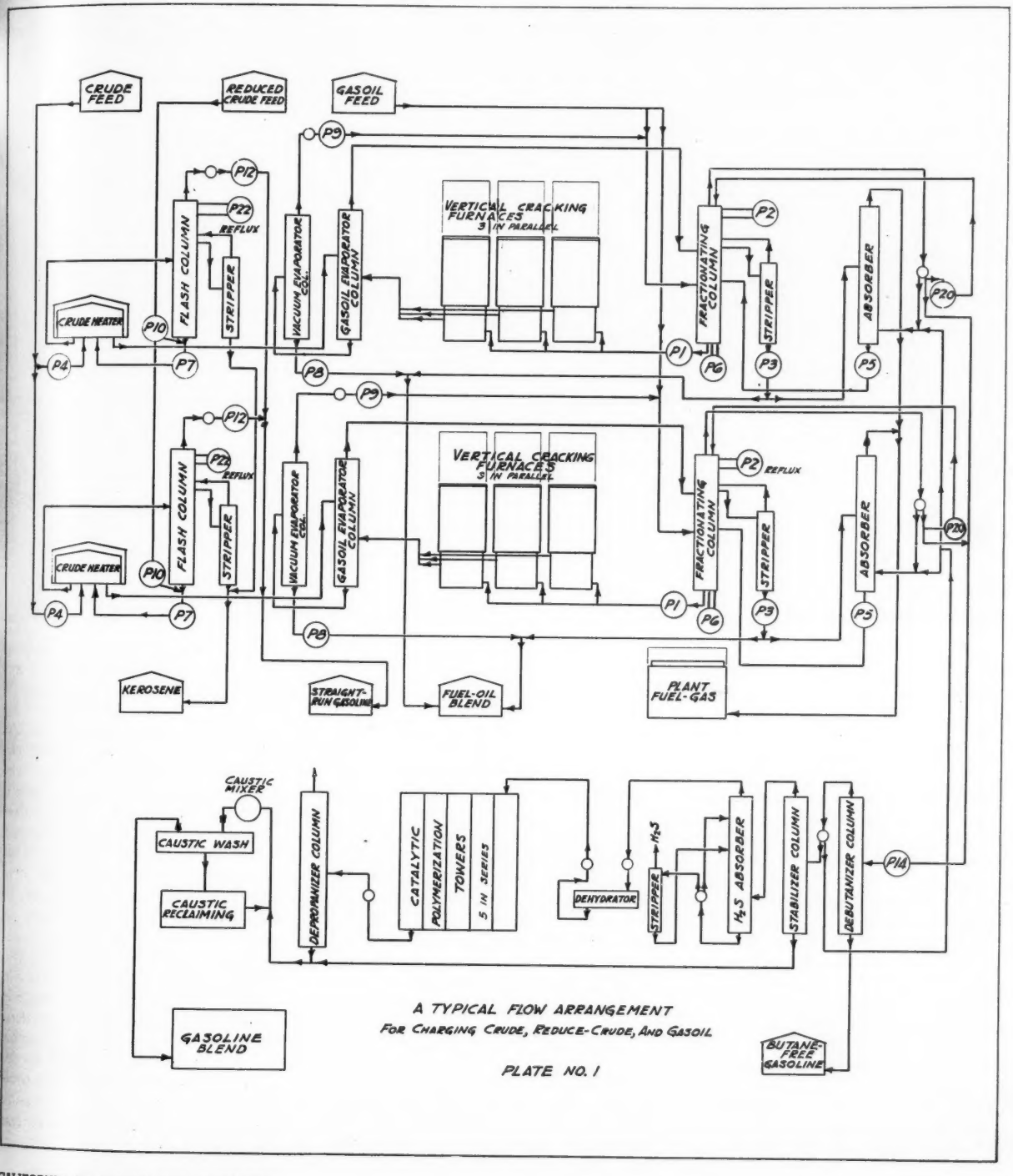
GENERAL ELECTRIC

011-485

bine driven. The units are designed to handle approximately 190 GPM against a discharge head of 60 lbs. per sq. in. The reduced crude is fed through the indicated jumper into the line handling the residuum from the flash column.

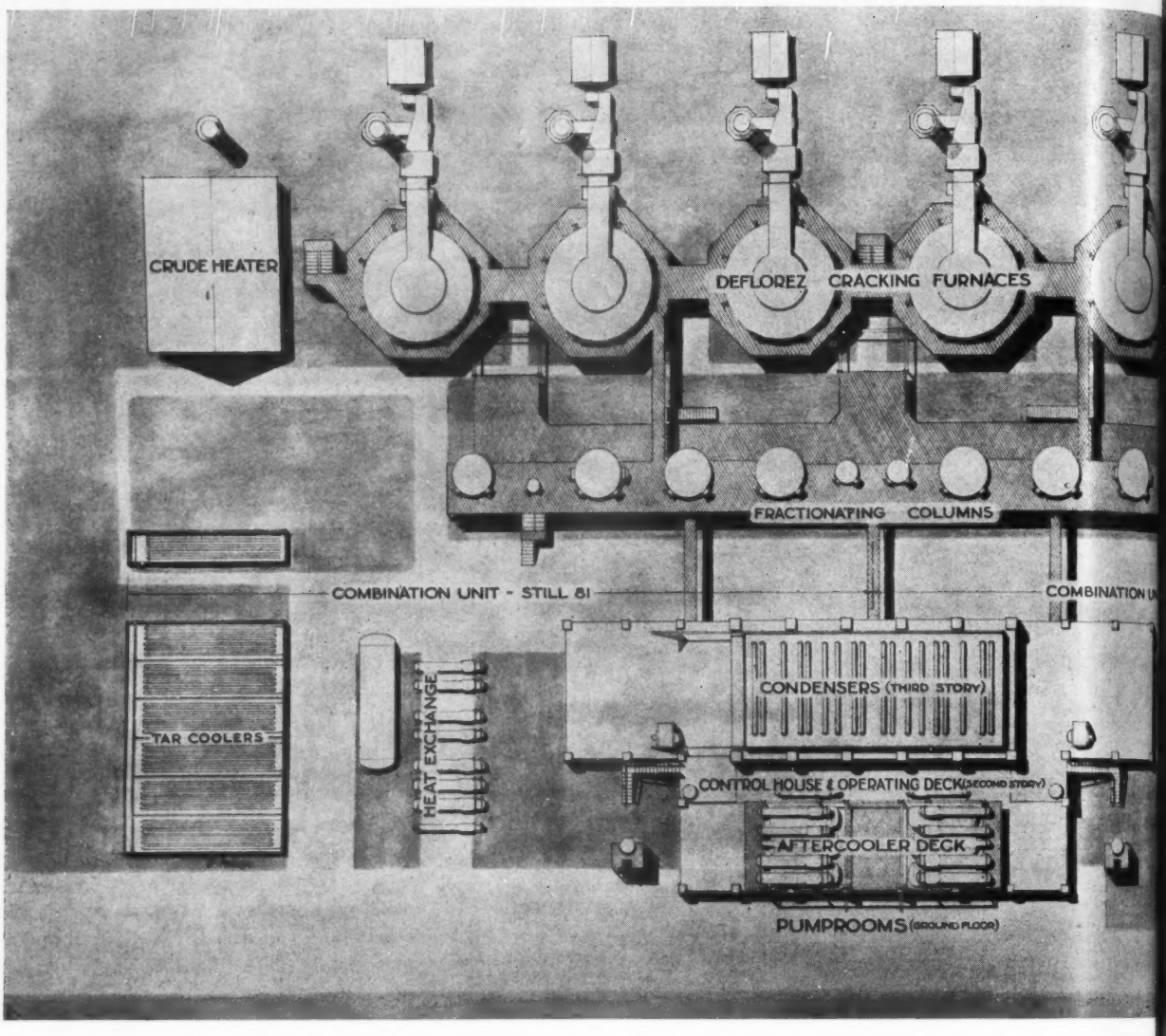
Item P-7 shows the location of the three residuum pumps, each of which is a vertically-split four-inch two-stage Type 4CGT centrifugal. These pumps, illustrated in Plate No. 4, are designed to handle approximately 770 GPM against a head of 270 lbs. at a temperature approximating 650 degrees. Two of the units are driven by 200 hp. Type KF motors with double extended shafts for the application of stand-by turbines, and the third is driven by a 200 hp. turbine.

The combined stream of cold reduced crude and hot residuum is passed through the second bank of the crude heater, and then discharged into the gas-oil evaporator column, which also receives the oil and vapors discharged from the cracking coils. The overhead vapors from this evaporator consist largely of cracked distillate which is passed directly to the fractionating column. The residue from this evaporator passes to the vacuum evaporator where it is subjected to distillation under high vacuum, the overhead products being vapors within the gas-oil range and which are condensed by heat exchange and which can then be passed to the fractionating col-



A TYPICAL FLOW ARRANGEMENT
FOR CHARGING CRUDE, REDUCE-CRUDE, AND GASOIL

PLATE NO. 1



umn. In addition to the two beforementioned products passing to the fractionating column, extraneous gas-oil feed may be used in varying quantities.

Item P-9 shows the location of the overhead pump handling the gas-oil from the vacuum evaporator.

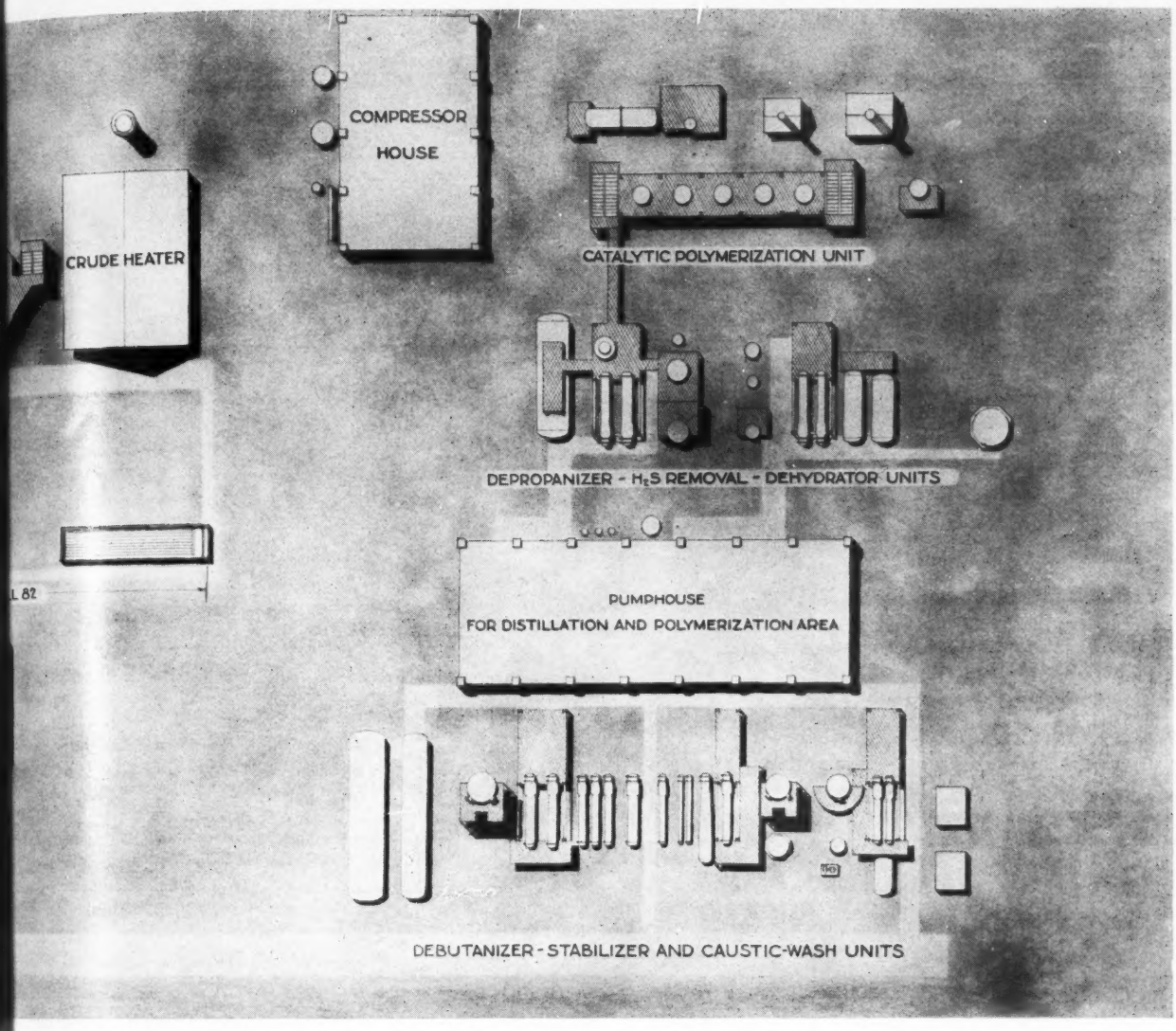
There are three of these pumps similar to that shown in the left foreground of Plate 5, each a three-inch two-stage Type 3GT2 centrifugal, two of which are driven by 40 hp. Type KF motors, and the third by a 40 hp. turbine. The pumps are designed to handle approximately 270 GPM of overhead at a temperature of approximately 150 degrees with a minus ten pounds suction pressure, and a discharge head of 110 lbs. with 12 ft. net positive suction head.

Item P-8 shows the location of the two hot tar pumps handling the residue from the vacuum evaporator column. One of these pumps is illustrated in Plate No. 6, being a heavy duty three-inch single-stage Type JVL centrifugal pump driven by a 100 hp. Type KF motor. These pumps are on a rather difficult service, and are designed to handle approximately 450 GPM of hot tar against a discharge pressure of 150 lbs. at a temperature of 750 degrees with a minus ten pounds suction pressure and 12 ft. net positive suction head. They discharge into the line leading to the fuel oil blending tanks after passing through heat exchangers and coolers.

The gas-oils produced by the above mentioned distillations and the fresh charge gas-oil come through the fractionating column and are picked up by the cracking coil charging pumps shown as Item P-1 and discharged into the vertical cracking furnace. These pumps —there are two installed with a third complete pump in the warehouse as a spare—are in reality the heart of the cracking unit. They are each eight-inch six-stage Type AHT centrifugal pumps of the most advanced design, and are designed to handle 1400 GPM of hot charge against a discharge pressure of 800 lbs. and with a temperature of approximately 660 degrees with 60 lbs. on the suction. The pumps are driven by General Electric 1000 hp. carbon dioxide-filled Type FT motors with double extended shafts for the application of auxiliary turbines. These motor driven charge pumps have the largest horsepower rating of this type of equipment in California refineries. A picture of the unit is shown in Plate No. 7.

These two 1000 hp. "inert gas-filled induction motors" were developed to operate in a Class 1, Group D hazardous location, and are the first carbon dioxide-filled induction motors ever built.

As shown in Plate No. 7, the motor is equipped with two surface air coolers, one attached to either side of the motor. Cooling water at approximately 80 degrees F. is circulated through the cooler coils, and maintains the temperature of the carbon dioxide mixture at less than 40 degrees C.



Carbon dioxide used internally in the motor is provided at a pressure slightly above atmospheric through a pressure regulating valve. Good fits, connections and bearing seals mean that only one 50 lb. cylinder of carbon dioxide is required every two weeks.

Separate electric motor-driven pumps supply lubricating oil under positive pressure to the spherical seat, sleeve type motor bearings. Oil under positive pressure enters the bearing at the horizontal split through a hole drilled up through the end shield and bearing seat. The oil flows over the journal in the direction of rotation, being returned to the sump by individual pipe lines from each end of the bearing lining.

Since the interior of the carbon dioxide-filled motor is slightly above atmospheric pressure, the oil from the inside end of the bearing lining is under slightly higher pressure than the oil discharged from the outside end of the bearing. Therefore, the two separate oil return lines go to a sump tank divided into two chambers by a vertical partition. A small hole in the partition tends to again equalize the oil pressure in the sump, while one of the two chambers receives the oil from the outside of the bearing at atmospheric pressure, and the other chamber receives oil from the inside end of the bearing at the internal pressure of the carbon dioxide atmosphere. A separate flow of oil under pressure through a regulating needle valve to an annular space around the bearing journal further insures a good gas-tight seal at the bearing. Insulated type bearings prevent any possibility of shaft currents.

Totally enclosed construction and the absence of any external air circulating fans or blowers makes these two 1000 hp. motors exceptionally quiet-operating. Their free-running characteristics are demonstrated by the fact that they will coast for approximately fifteen minutes after the power is disconnected before coming to a standstill.

The discharge from the furnaces enters the gas-oil evaporator column and its overhead of pressure-distillate and some gas-oil flows to the fractionator which is designed to produce three cuts, namely: an overhead of pressure-distillate, a side stream of gas-oil, and a bottoms for return to the cracking furnaces. Item P-6 shows the general location of the tower bottoms recirculating pumps. Each of these three units is a four-inch single-stage Type 4JVL centrifugal pump designed to handle approximately 770 GPM against a discharge pressure of 135 lbs. with a temperature of about 650 degrees. Two of these pumps are driven by 60 hp. Type KF motors, and the third by a 60 hp. turbine.

At Item P-2 is located the fractionating column reflux pumps. There are three of these pumps also, and they are each three-inch single-stage Type 3JVL centrifugals, driven in two cases by 40

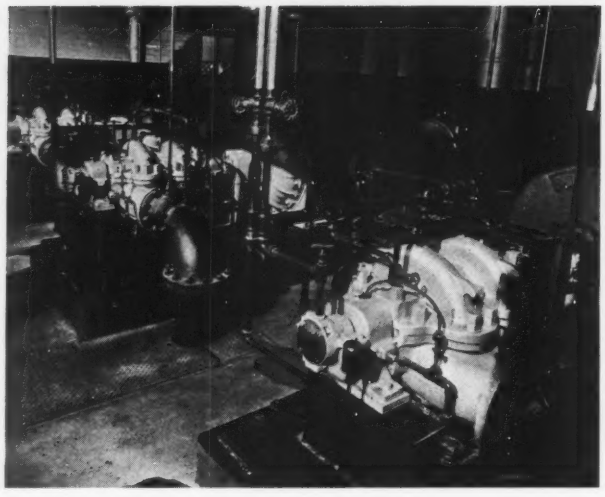


Figure 2
Three charge pumps pull crude from tank storage about a mile away from the refinery. These pumps are really the start of the refining process.

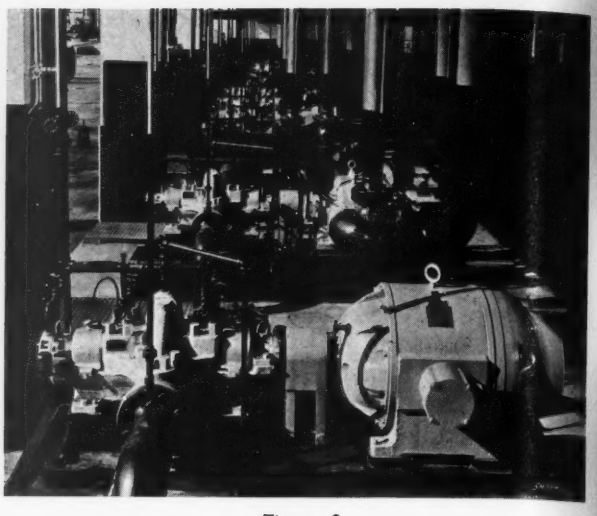


Figure 3
The first three pumps shown here are handling cold reduced crude. The second three are handling fat oil and pumping it to the absorbers.

hp. Type KF motors, and in the third by a 40 hp. turbine. The units will handle approximately 500 GPM of reflux at a pressure of 125 lbs. with 60 lbs. on the suction and at a temperature of 400 degrees.

The main side cut pumps, Item P-3, are of the single-stage type, and are three-inch Type JVL, each designed to handle approximately 460 GPM against a discharge head of 155 lbs. at a temperature of approximately 500 degrees. The pumps are driven by two 50 hp. Type KF motors and one 50 hp. turbine. Their function is to take the discharge from the stripper and control temperature of reactions in the absorber.

The fat oil from the absorber is handled by the pumps at Item P-5 which are two-inch single-stage Type JVL centrifugals. Of these three pumps, which are driven by two 40 hp. Type KF motors and one 40 hp. turbine, each handles about 220 GPM of product against a discharge head of approximately 150 lbs.

The overhead pressure distillate from the fractionator is picked up by Type 1½ JVL single-stage pumps at Item P-20 acting as main column reflux pumps and eventually discharged into the two debutanizer charge pumps at Item P-14. These are illustrated in Plate No. 8.

The Item P-20 units are designed to handle about 70 GPM against a discharge pressure of 125 lbs., and the Item P-14 units will handle about 350 GPM against a discharge head of 195 lbs. There are two 15 hp. Type KF motors driving two of the main column reflux pumps and a 75 hp. Type KF motor driving one of the debutanizer charge pumps. The other two units are turbine-driven standbys.

In the polymerization unit there are two additional centrifugal pumps, one handling plant water and the other acting as a caustic mixing unit. Both of these pumps are single-stage Type CRV motor-driven units.

In this same new refinery addition, although not shown on the flow sheet in Plate No. 1, are located three compressors installed with the above pumps. This equipment was also furnished by the Ingersoll-Rand Co. and consists of a 600 hp. 17½x30x21 Type PRE synchronous motor-driven plant air compressor, a 100 hp. 17x13 Type ESE-1 synchronous motor driven compressor for furnishing air used in regenerating in

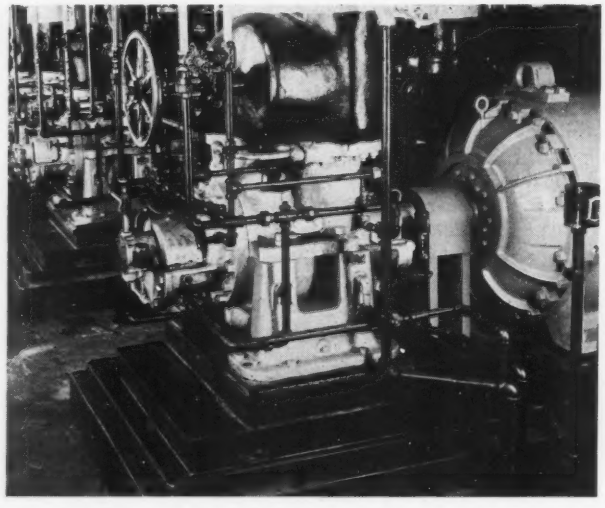
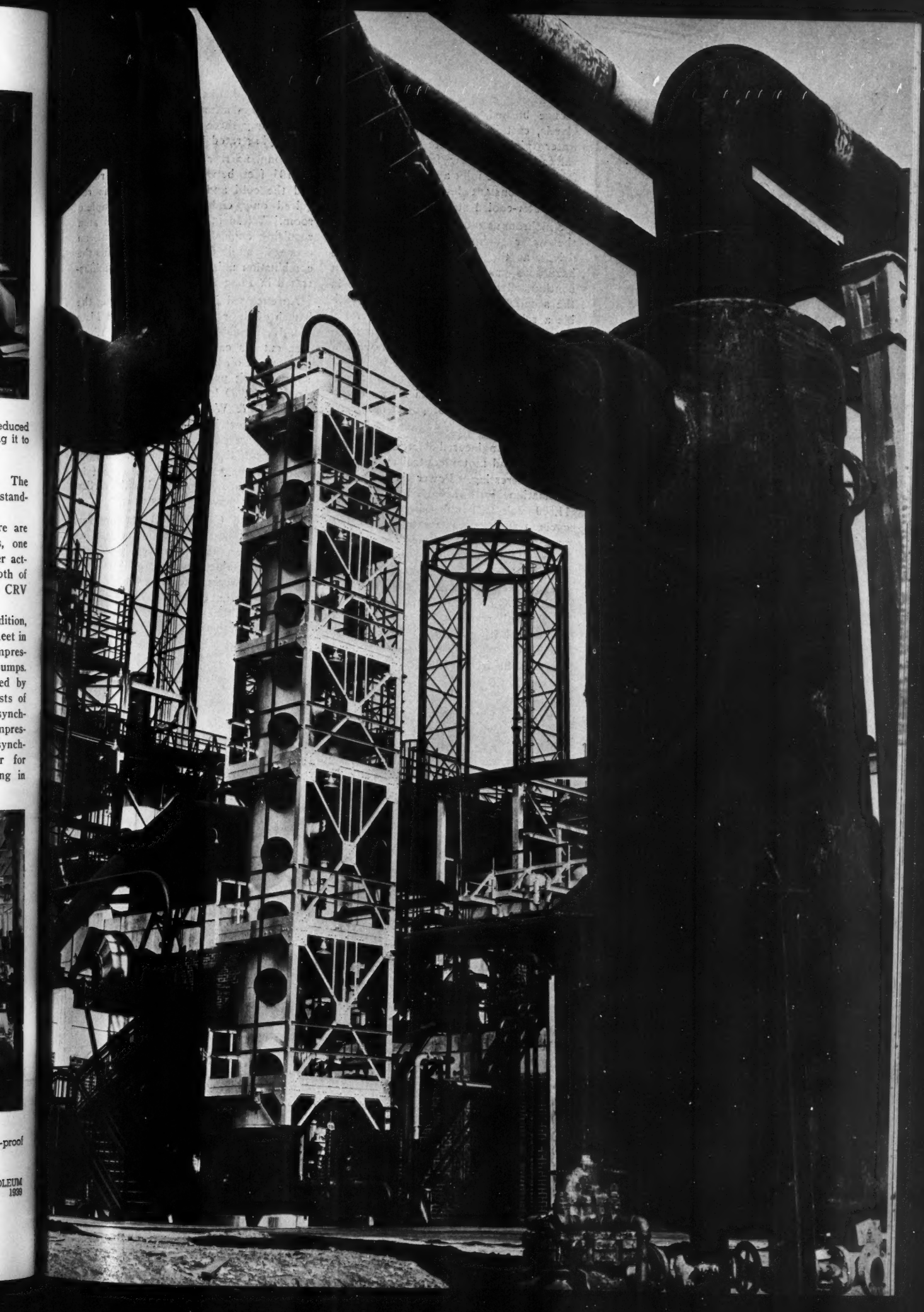


Figure 4
Three residuum pumps pumping "hot bottoms" from the crude still to cracking stills.

Figure 5
Three centrifugal pumps driven by two 40-h.p., explosion-proof induction motors and a 40-h.p. turbine.



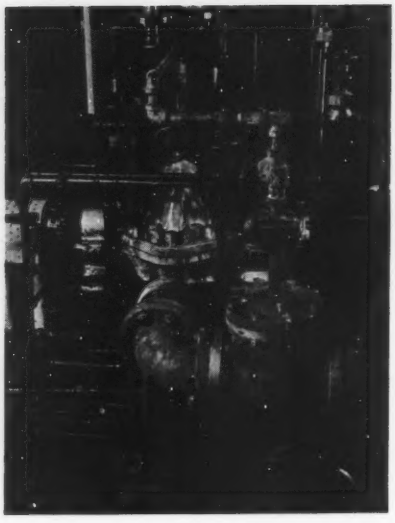


Figure 6
One of three single-stage, centrifugal, hot-tar pumps handling the residue from the vacuum evaporator column.

the polymerization unit and a 15 hp. 8x7 Type ES-1 induction motor-driven instrument air compressor. A partial view of this installation is shown in Plate No. 9.

All of the pumps and compressors described above were furnished by the Ingersoll-Rand Co., and all of the driving motors as well as the control and auxiliary equipment, were furnished by the General Electric Co. Both of these manufacturers cooperated with the designers in furnishing units incorporating special features desired from the standpoint of maintenance and safety, with the result that the installation is outstanding in many ways. A few of the pump features include Fast forged steel flexible couplings, coupling guards, bronze bushed quenching type hooded glands, cast iron gland guards, cooling water piping complete with control valves, and overflow funnels all manifolded into one inlet and one outlet connection, constant level oil lubrication, and water-cooled stuffing boxes.

Synchronous motors were selected for the water pump, compressor and fan drives, as they are located outside the hazardous gas area and operate almost continuously. A power-factor clause in the schedule of the utility makes possible a rebate on the monthly power bill not to exceed 10% of that bill for average power-factor maintained above 70.7 per cent. This warranted the use of 0.8 power-factor synchronous motors, and subsequent operating data shows exceptionally high values of power-factor for this refinery.

The well-engineered electric power distribution and motor control systems are very interesting. Power is served at Substation No. 1 through nine 1000 kva, 11,500 volt-2300 volt single-phase, 50-cycle transformers arranged in three parallel banks of three transformers each. This 2300 volt secondary carried a short circuit rating of 66,200 kva, which was reduced to a value of 40,000 kva by Richfield Oil Corp. with an installation of 2300-volt reactors. A second bank of reactors further reduced the interrupting rating to the desired value of 15,000 kva for the feeders to the older existing part of the refinery.

From the 40,000 kva interrupting capacity bus, four separate parallel feeders carry 2300-volt power approximately 1200 feet to circuit breaker panels rated 50,000 kva each in the combination unit switchboard room shown in Plate No. 10. Induction over-current and reverse power relays afford protection to these feeders, any three of which are capable of carrying rated load if necessary.

A long, narrow available area 13 feet by 105 feet between the control room and the cold and hot pump rooms required only ends to form a complete room. While in a semi-hazardous area requiring explosion-proof equipment, an economic study determined its use as the combination unit switchboard room illustrated in Plate No. 10.

An enclosed 2300-volt bus running the length of the room on the right in Plate No. 10, furnishes power to D & W oil fuse cutouts capable of serving the dual purpose of oil-immersed disconnects and short circuit protection. Reactive links provide 40,000 kva interrupting capacity in the D & W cutouts serving all the General Electric type CR7006-R1B full voltage starters for all the 2300-volt motors except the two 1000 hp. charging pump drives. The D & W cutout installations are streamlined with vertical steel cover panels as illustrated.

The Type CR7006-R1B starters have all contacts and connections at least six inches under oil, and are equipped with simple, portable lowering equipment to facilitate lowering the tanks when desired.

Much faster operating characteristics than the CR7006-R1B insure that the D & W reactive links will always safely open a short circuit before the starter can open.

The two 1000 hp. motors receive power through D & W cutouts equipped with copper straps serving as disconnects only. Short circuit as well as operating protection is provided by General Electric Type CR7006-C2AY full voltage oil-immersed magnetic starters having 50,000

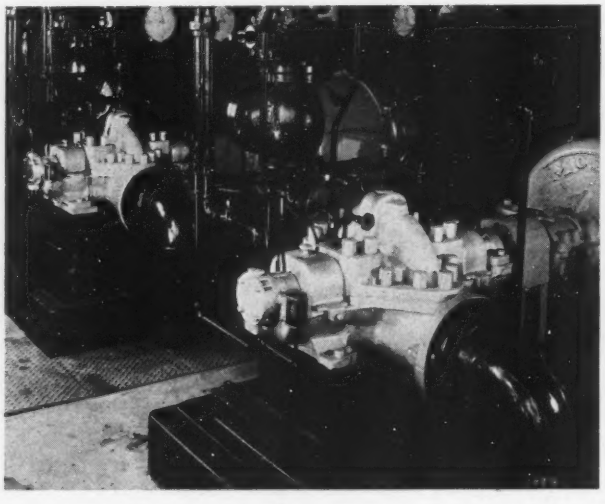


Figure 8
Two debutanizer charging pumps driven by a 75-h.p. induction motor and 75-h.p. turbine.

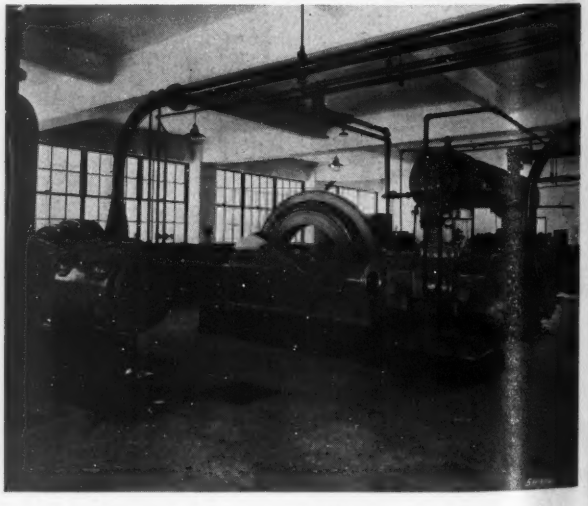


Figure 9
Two large synchronous-motor-driven air compressors which also supply furnace gas to recharge the catalyst towers.

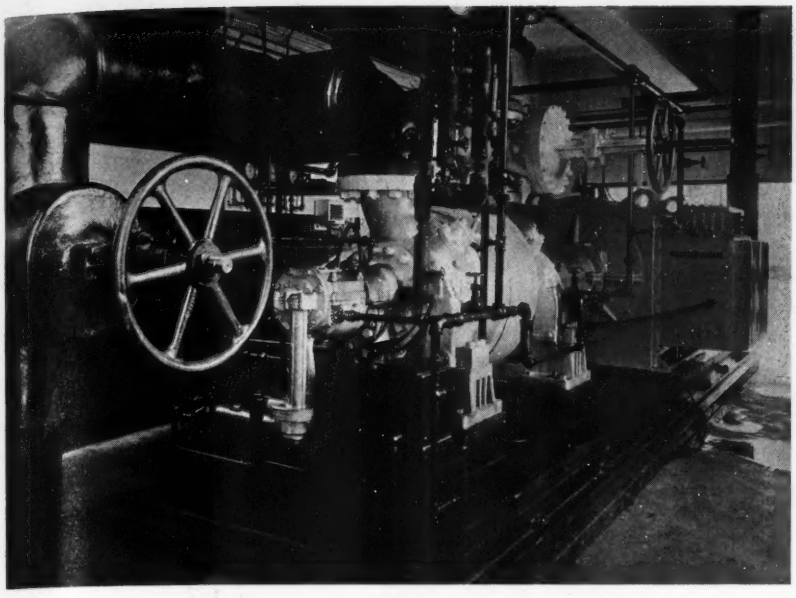


Figure 7
One of two 1000-h.p. totally-enclosed, inert-gas-filled, squirrel-cage induction motors driving the main hot-oil charging pumps.

kva interrupting capacity. The contactor is a 3-pole latched-in type with double-break butt-type contacts. The oil blast principle of arc interruption is responsible for the high interrupting rating. Short circuit protection is provided by three series, magnetic instantaneous overcurrent trips that act directly on the contactor latch.

All the General Electric Type CR7006 oil-immersed magnetic starters used in this new refinery addition provide overload protection with induction thermal overload oil-immersed relays.

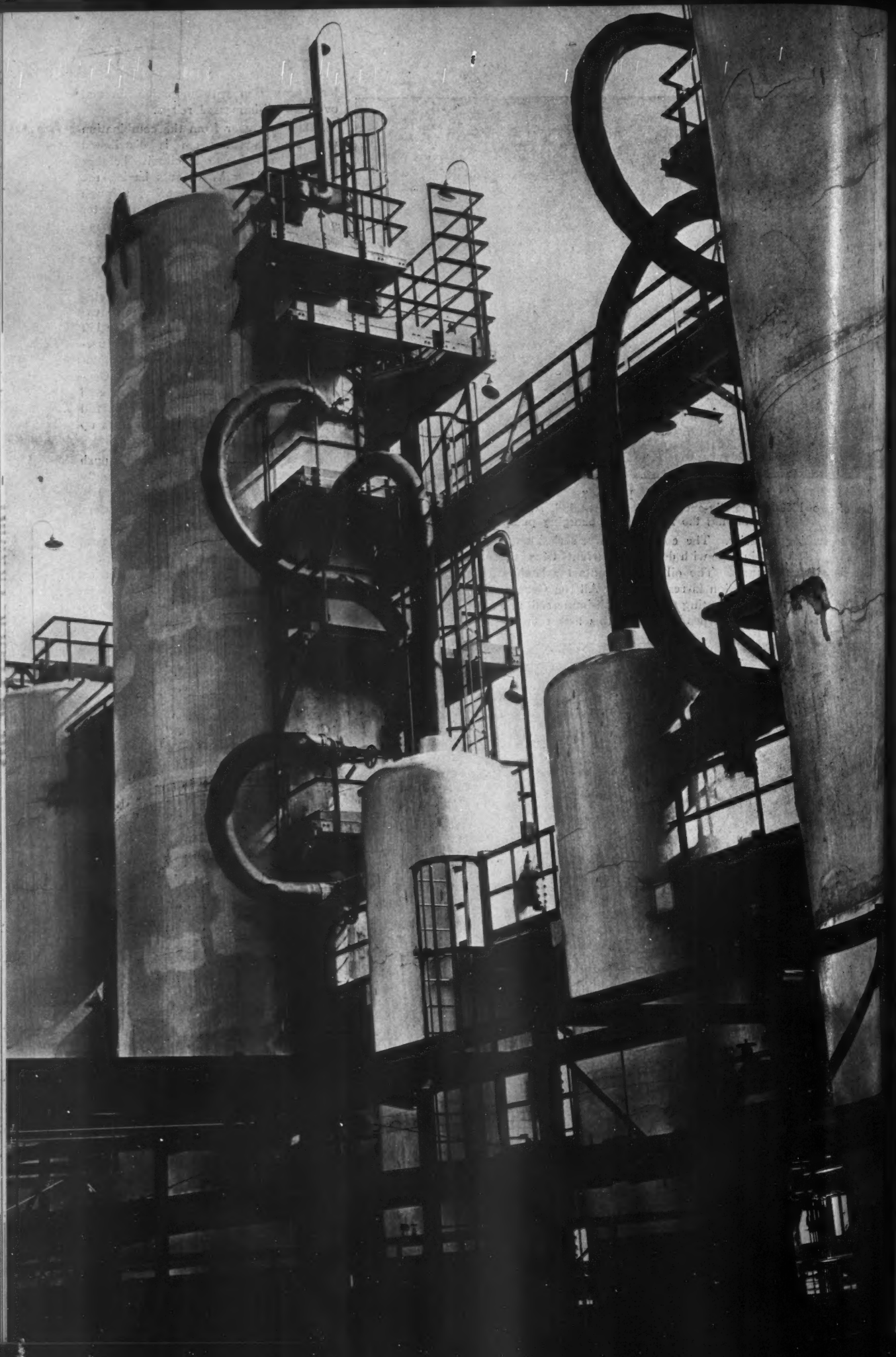
2300-volt power from the combination unit switchboard room is distributed through suitable oil circuit breaker panels and D & W cutouts having the desired short circuit capacity, through feeders to the compressor plant, water pump and fan motors, a transformer bank providing 440-volt 3-phase power and another transformer bank providing power for lights and auxiliary control.

From the transformer bank supplying 440 volts, a feeder brings power to explosion-proof controls shown on the left side foreground of Plate No. 10. Crouse-Hinds explosion-proof fittings containing circuit breakers feed power to General Electric Type CR7006-B52A and B53A oil-immersed explosion-proof full voltage magnetic starters for motors up to and including 50 hp.

Explosion-proof "start" "stop" push button stations are located, in practically all cases, adjacent to their respective motors for convenience of the operators.

Subsequent operation of this new refinery unit has demonstrated the general excellence of the engineering applied and the ability of the pumping and electrical installations to amply meet the requirements of this outstanding new refinery addition of the Richfield Oil Corp.

Figure 10
Explosion-proof motor-switching equipments (440-volt motor control on left and 2300-volt motor control and feeders on right).



Rerun Unit

By C. C. Steward and E. V. Lane
Bechtel-McCone-Parsons Corporation

In order to provide modern facilities for the redistillation of pressure gasoline from their new cracking units, the Richfield Oil Corp. awarded a contract to the Bechtel-McCone-Parsons Corp. of Los Angeles on Feb. 11, 1938 for the design and construction of a new rerun unit which now forms an important link in the new refinery processing scheme.

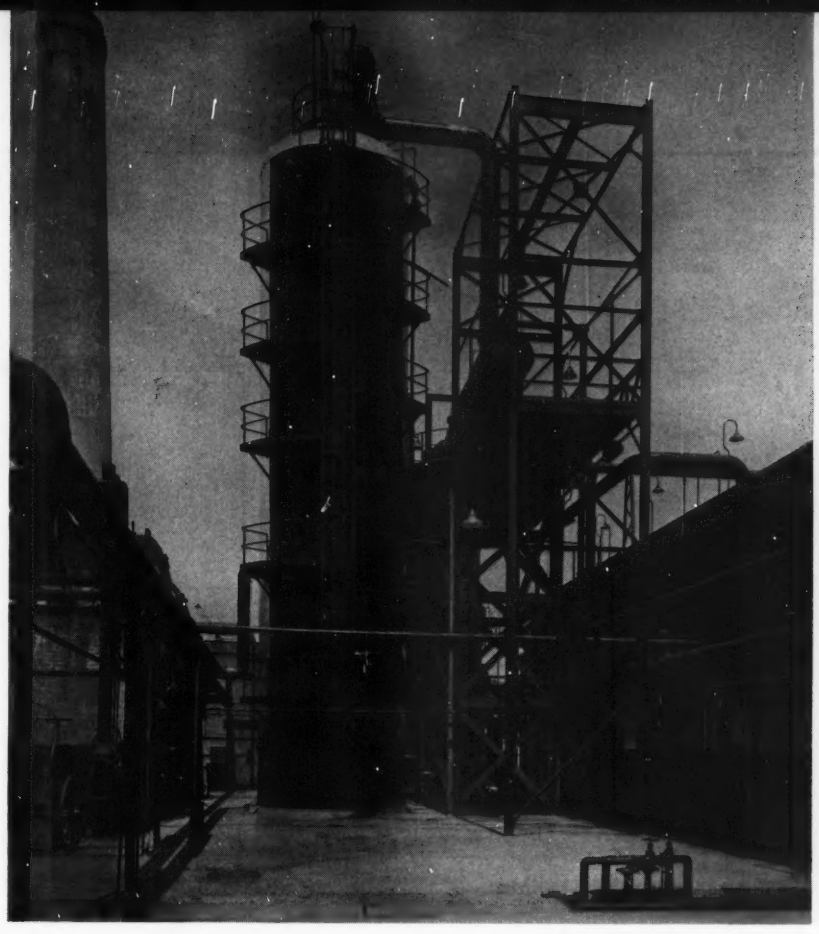
The process design, worked out by Richfield and Bechtel-McCone-Parsons engineers, provides for the redistillation of treated, debutanized pressure gasoline at substantially atmospheric pressure in the presence of steam, to yield as the principal product a well fractionated overhead gasoline free from undesirable heavy fractions.

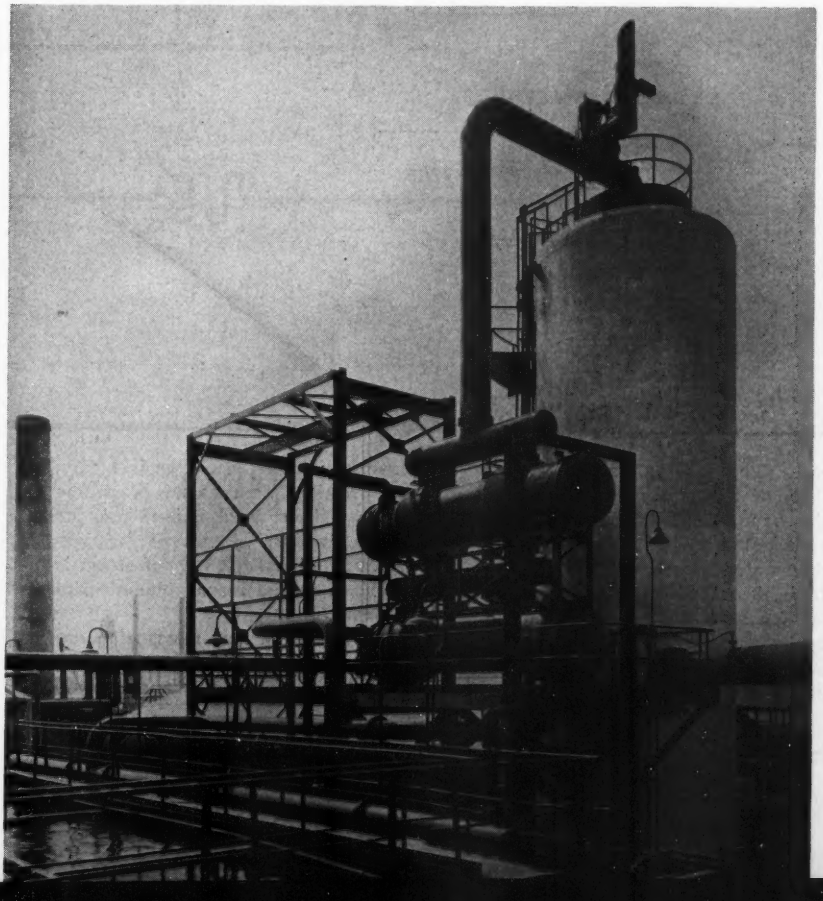
Construction of the new unit presented several novel problems because the logical site for the unit was a badly congested area containing an old crude distillation unit and its auxiliaries. Part of this old equipment was to be modified so that it could be used in the new rerun unit while the remainder was to be abandoned and removed from the site. It was necessary to dismantle and take out approximately 200 tons of pressure vessels, their foundations and piping, together with about 50 tons of structural steel platforms and walkways. This demolition work, carried out by the Construction Department of Bechtel-McCone-Parsons, had to be completed with a minimum of disturbance to operating equipment, before foundations could be installed for the new apparatus.

The equipment of which this unit is composed consists of an atmospheric fractionating column, overhead vapor heat exchangers, condensers, coolers, reflux accumulator tank and a direct fired heater used as a reboiler. This equipment, together with all piping, instruments, controls and pumps provides the refinery with a compact, efficient, easily controlled rerun unit which operates in conjunction with existing chemical treating equipment.

The new 75 ton fractionating column was completely assembled in a shop and erected in the field in one piece. All bubble trays and caps were closely checked for level after erection.

In operation, pressure distillate from the new cracking units, after having been debutanized, is pumped through the rerun unit vapor heat exchanger and thence to direct fired heaters in the treating plant, where it is completely vaporized under low pressure. These vapors are treated as required and flowed directly into the new fractionating column flash section. Heavy ends in the base of the column are picked up by a pump and circulated through the direct fired reboiler back into the column below the flash section. The rate of this recirculation and the temperature leaving the heater are regulated so that the amount of heat required to carry on the separation is supplied to the column at a uniform





Two views of installation by Bechtel-McCone-Parsons for processing pressure gasoline.

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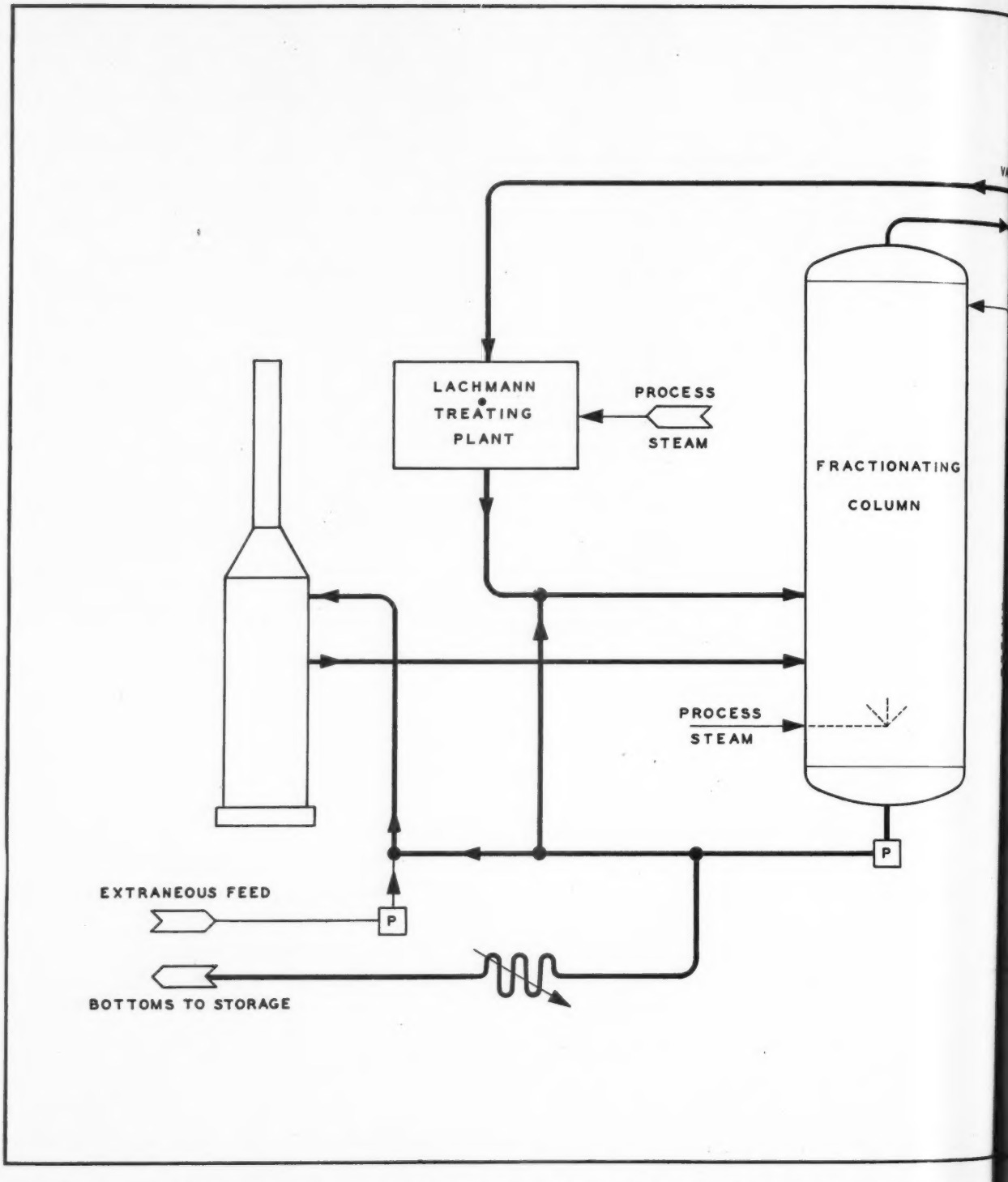
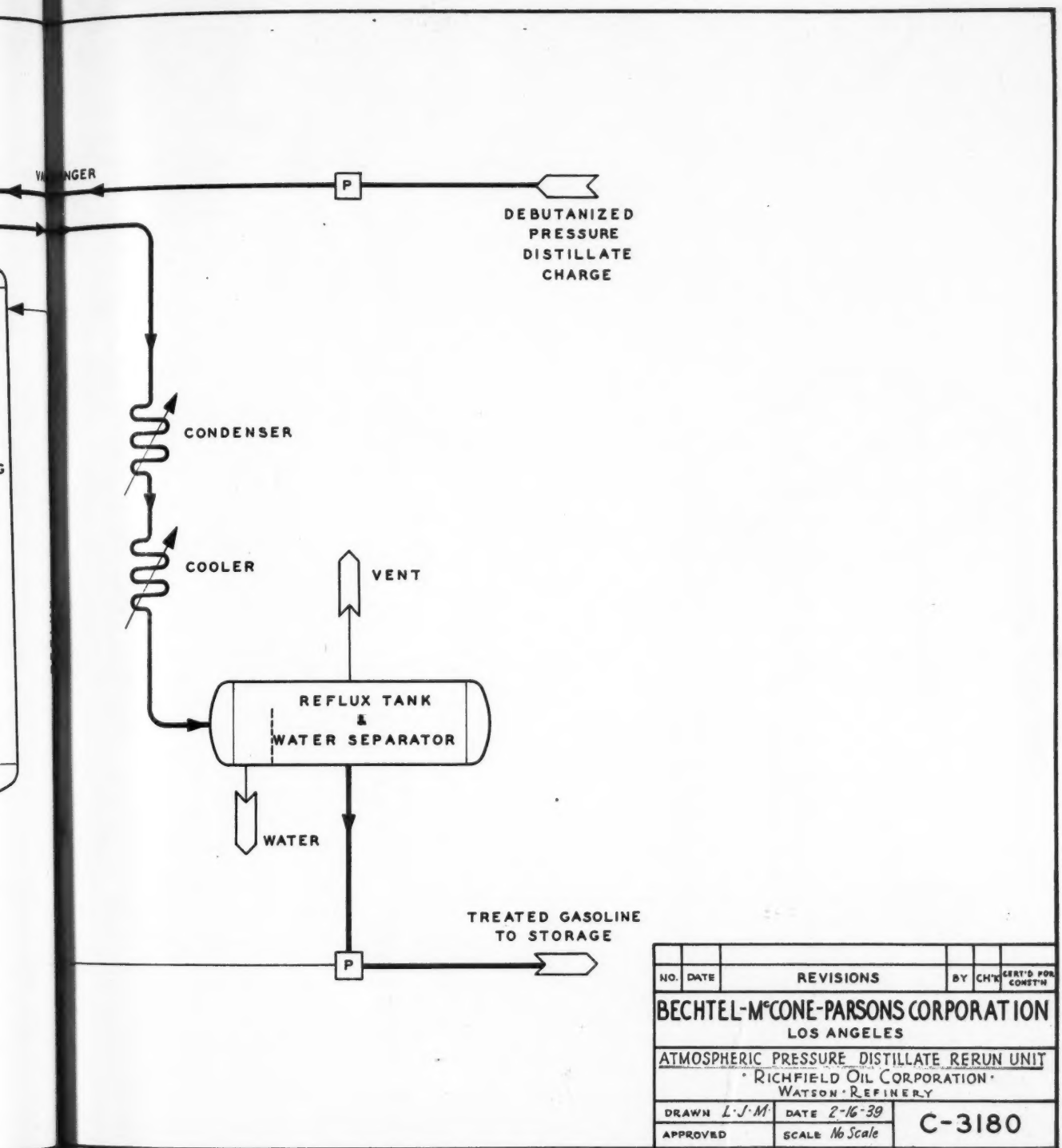


rate. The vapors, after passing up through the rectifying trays, flow into the vapor heat exchanger, condensers and coolers and accumulate as liquid in the water separator. Water removal from the separator is effected by automatic control while the gasoline is picked up by a pump and flowed to storage, a portion being returned to the top plate of the fractionator as reflux. Complete vaporization of the charge is secured in the treating plant ahead of the rerun unit by direct fired heaters and steam. To control the degree of stripping, a small additional quantity of steam is introduced in the rerun column stripping section.

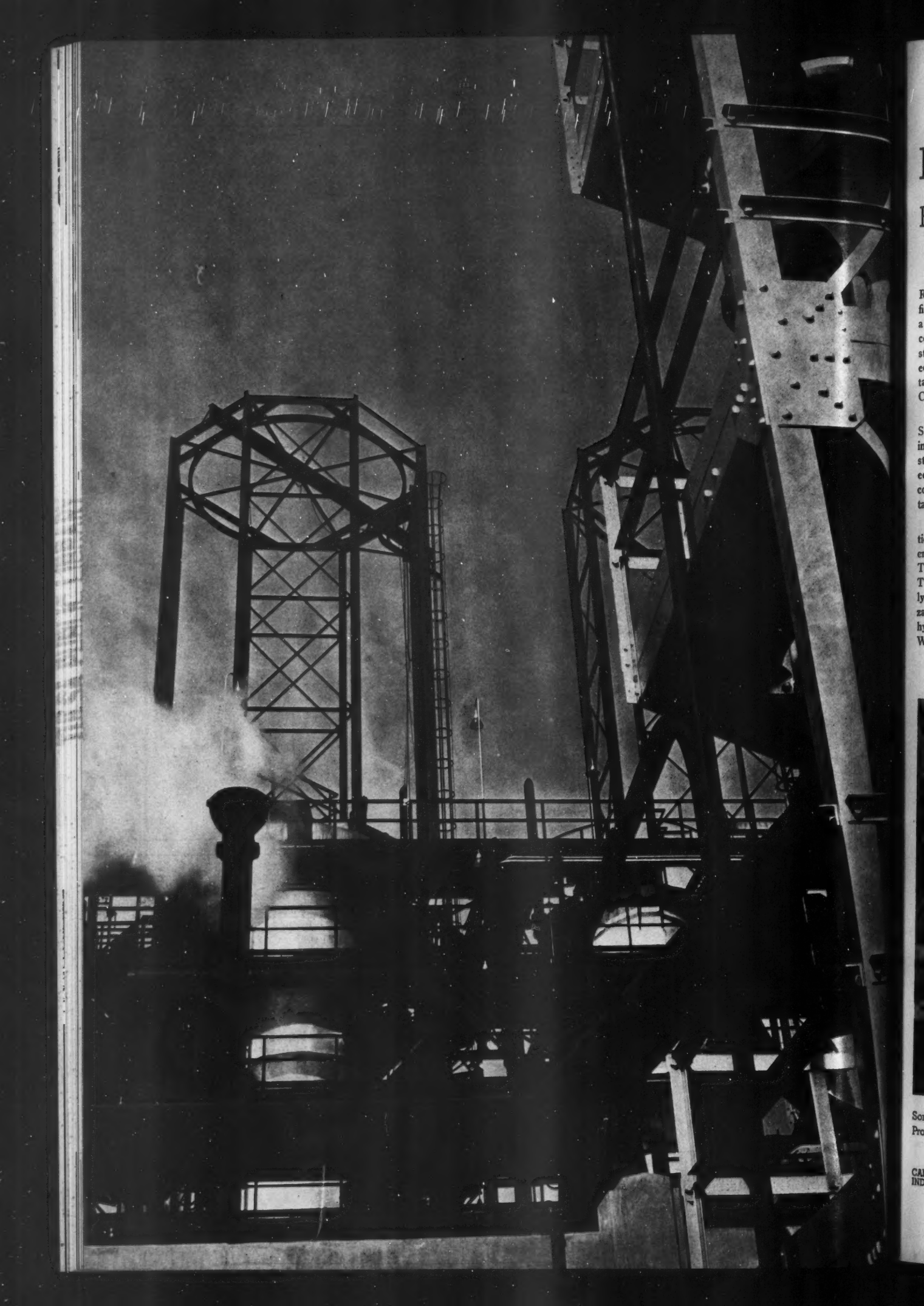
All important flow rates, temperatures and pressures are automatically controlled by instruments mounted on a centralized control panel which is conveniently located for the plant operators.

It was realized that a substantial saving to the refiner in capital investment could be made by modifying and repairing certain portions of the old crude unit, and to this end the engineers of Bechtel-McCone-Parsons and Richfield cooperated to the fullest extent throughout the design and construction period.



The new unit was placed in service June 27, and with the exception of one shutdown for inspection has been in continuous service since. In the accompanying table is shown typical operating data, from Richfield records.

Rates of Flow, Barrels per Day	
Raw pressure distillate charge	8,980
Overhead distillate to storage	8,000
Reflux Pumpback	2,170
Bottoms to storage	980
Recirculation rate	4,090
Vapor line feed	882
Extraneous feed	836
Total redct. steam, lbs. per hr.	20,150
Temperatures, Degrees Fahrenheit	
Press. dist. chg. to vpr. ht. exch.	82
Press. dist. chg. out vpr ht. exch.	222
Vapor feed to column	338
Vapor out column	274
Distillate to storage	76
Base of column	374
Extraneous feed to heater	90
Recirculation to heater	321
Recirculation to column	425
Liquid feed to vapor line	370
Pressure, lbs. per sq. in. Gauge	
Bottom of column	10.2
Vapors to exchangers	5.8
Process steam	21.0



Richfield Refinery Construction Data

Builder Sets New Safety Mark

The installation at Richfield's Watson Refinery, represents one of the largest refinery construction projects executed on a single contract—some $5,000,000. The coordination of all phases of the construction—the manufacture of the major equipment, the field erection—was undertaken and completed by C. F. Braun & Co.

The process design was provided by the Sinclair Refining Company. The working drawings were prepared by the Braun staff. The Sinclair and Richfield engineers worked jointly with Braun in the completion and settlement of design details.

The main plant is a Double Combination Unit for combined topping and cracking—two units operate in parallel. The total charge is 50,000 barrels per day. The auxiliary units, installed concurrently, take care of Debutanization, Stabilization, Hydrogen Sulphide Removal, Dehydration, Depropanization, Caustic-Wash, and Catalytic Polymerization. And the new refinery water system, cools and circulates 24,000 GPM—35,000,000 gallons per day.

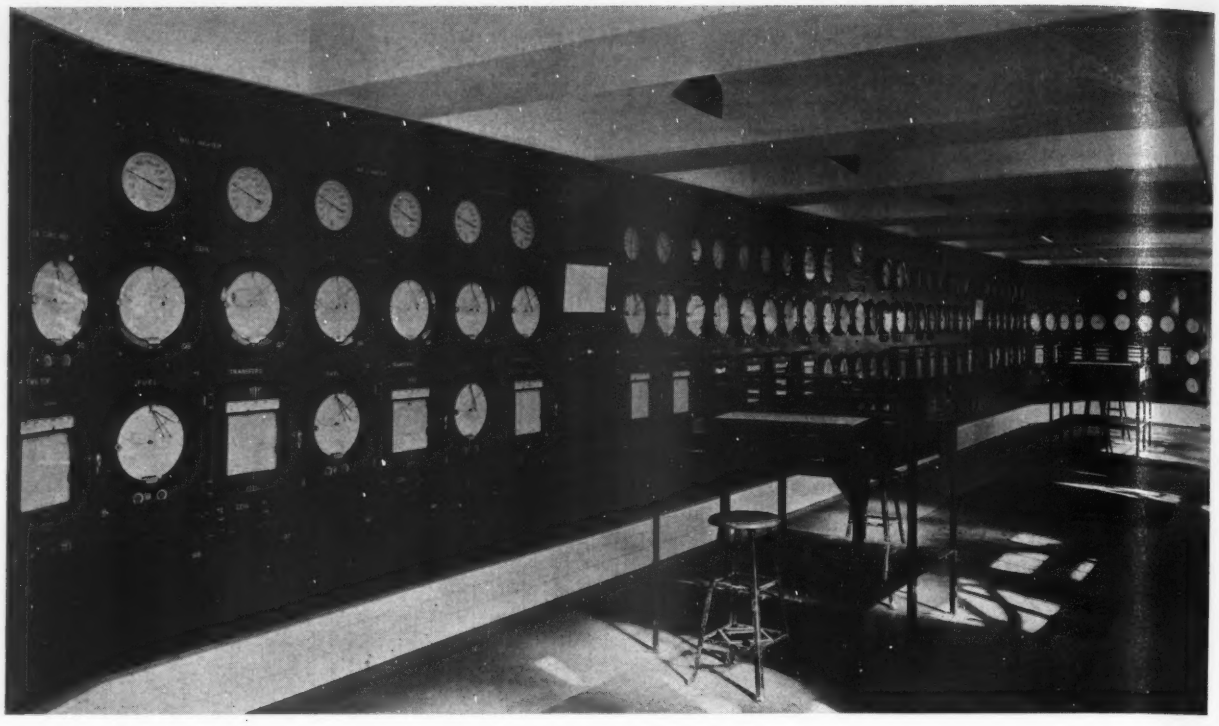
Contrary to the common practice of doing much of the work in the field, this plant was largely shop fabricated. At the Braun plant, all of the major refining equipment was manufactured, and some 10,000 units of piping and accessories were fabricated and tested. All of this was shipped to the site ready for field assembly. The field crew averaged less than 250 men.

There are throughout the plant, twenty-two Braun bubble columns and 110 Braun heat exchangers, condensers and coolers. The bubble columns range from 4 feet to 13 feet in diameter, and weigh from sixty to one hundred and forty tons each. Sections of the cracking columns operating above 600° F., are lined with 11 to 13 percent chrome alloy, and are equipped with alloy bubblecaps and trays. High temperature exchangers are similarly protected and are equipped with alloy tube bundles. All of the columns, exchanger shells, and pressure vessels are stress relieved.

The coordination and scheduling of all phases of the work was planned and conducted throughout the job by the Braun production division at Alhambra. Delivery of equipment and materials to the field was coordinated with the planned erection schedule, so as to permit moving a majority of the work direct into position from cars or trucks, without rehandling.

The foundations and reinforced concrete buildings required some 7,000 cubic yards of concrete—all 3,000 pound test material. The main pump and receiving house, involving 800 yards, was poured in two stages: the lower floor, framework, and ceiling in a continuous pour, 580 yards in 21 hours; and the top-floor and roof, 220 yards in 7 hours. All large foundations and building structures were compacted by use of vibrating machines on the concrete. All concrete work and

Some of the Braun staff responsible for the new Richfield Refinery. Left to right: H. W. Cunningham, Field Engineer; J. F. Haines, Process Engineer; P. C. McGrath, Process Engineer; J. A. Marchant, Vice President; L. I. Blennerhassett, Engineer; H. W. Finney, Field Superintendent; A. M. Whistler, Process Engineer; T. J. Lingle, Purchasing Agent; H. S. Selindh, Chief Draftsman.



Main panel in central control room.

other structures, were built with horizontal and vertical reinforcements for earthquake resistance.

The steel structures, furnaces, support-steel, platforms, craneways—involve some 2,000 tons of steelwork. Provision for earthquake resistance is included in each structure. Gantry cranes with traveling hoists, are provided for the removal and handling of heat exchanger heads, tube bundles, and condenser sections. And monorail hoists serve for the handling of furnace tubes and headers.

Modern construction equipment contributed to the fast completion schedule and to the economy of installation. A gallows frame and three heavy duty hoists, suitable for vessels 15 feet in diameter and loads of 175 tons, were used for erection of the large bubble columns.

Other rigging equipment included three traveling cranes, two riggers hoist trucks, seven tugger hoists, and a stiff-leg derrick. Highlines, suspended from 110-foot gin poles and served with power hoists, were used for rigging piping and accessories into restricted areas.

Two spur tracks were installed so as to extend throughout the plant area in such location as to provide for convenient handling of the major equipment. The rigging facilities were arranged so that the large bubble columns, weighing 90 to 140 tons each, were hoisted and placed on their support structures within one hour from the time the carloads were spotted in position. The columns were manufactured and shipped in planned order so that the rigging equipment could be moved in one direction in short steps, without back tracking. Most of the major equipment, and many of the accessories, were set in position direct from cars and trucks.

The major equipment, auxiliaries, process lines, and utility services, were completely designed so that the field operations were limited to mainly a matter of assembly rather than fabrication and erection.

The piping—comprising some 6,000 separate units—was fabricated and tested at the Braun plant. The process lines for temperatures 600° F. and higher, were fabricated from alloy steel, and were provided with vanstoned flanged joints, so as to avoid insofar as possible, the use of welding on the alloy steel. These lines were made of very low carbon alloy steel with columbium, to reduce the possibility of air hardening defects. Vanstoned joints of the globack form, were used for services requiring Series 30 or higher pressures. All other process lines were of carbon steel construction; cast iron served only for low pressure utilities.

The electrical power distribution system is carried underground, both between the several units, and within the units. Wiring for lights and instruments was run in conduit mainly overhead and supported on racks. The underground wiring is lead covered cable, run in conduits, which are encased in concrete.

The electrical installation includes some forty miles of lead covered cable and rubber covered wiring, and over sixteen miles of thermocouple wiring, all carried in galvanized conduit. In addition, many miles of instrument piping and conduits are routed throughout the units, in support racks. The instrument lines are located in a uniform and accessible pattern and are marked for the quick identification of any line.

The six deFlorez vertical cracking furnaces, have as heat absorbing surface, a total of some seven miles of alloy tubing. The tubes are rolled into alloy steel headers. There are 1,900 of these rolled joints. No leaks occurred on any of these joints, either under hydrostatic test or during operation under temperature.

The care taken in the alignment of the pumps, motors, and turbines, paid big dividends when the plant went on stream —operation was not once interrupted. Each of the fifty pumping units in the main plant, and the forty pumps in the auxiliary units were aligned, shimmed, and grouted, and the alignment was rechecked after the pumps were run-in. A seal oil system was inter-connected to the stuffing boxes of pumps in severe services for hot oils and for cold light gravity products. This system, and the care taken in the packing of stuffing boxes, contributed to the excellent record of negligible stuffing box troubles.

The refinery water system, installed concurrently, is of mammoth proportions.

It cools and circulates 24,000 GPM—the equivalent of the requirements for a city of some 300,000 people. An existing cooling tower was rebuilt, and a new Braun cooling tower installed. Four pumps handle the load, two pumps each driven by a 400-HP motor, circulate through the refinery; and two pumps each driven by a 250-HP motor, lift from the hotwell over the towers.

The water mains are 36-in. diameter, and are made of shop-fabricated welded pipe in 60-foot sections. One unusual requirement is the spanning of a county storm channel running through the refinery. Here the two 36-inch water mains make an unsupported span of 70 feet from footing to footing—the suspended mains are reinforced to provide for the unsupported span and for loads from earthquakes.

The completion of hydrostatic tests was followed immediately by a period of flushing out and circulation on cold gas-oil. The pumps were run-in and checked. Instruments and controls were tried out, and the flow directions were determined. These inspections and pre-operations, were conducted with great thoroughness by the Sinclair and Richfield engineering and operating staffs.

Capacity operation was attained within one week from the start of the initial runs. Both combination units, and all the auxiliary units, remained on stream, continuously from the start, for initial runs of 30 days—and then the shutdowns were voluntary, for the purpose of inspection. There was not a single forced shutdown.

The major instruments used at this refinery are mounted on three main panel boards designated respectively "Combination Units," "Stabilizer and Debutanizer Units," and "Polymer and H_2S Removal Units." There are 137 instruments on the first board, 29 on the second and 30 on the third. Of the total, 139 were supplied by the Brown Instrument Co. These include recording flow, liquid level, pressure and temperature controllers of the Air-O-Line pneumatic type; recording flow meters of the mechanical and electrical transmission types; multiple pen pressure and temperature recorders and indicating potentiometers. Two of the indicating potentiometers are coupled with key switch panels each having 96 points. The number of the recording instruments required was materially reduced by adding approximately 75 extra pens to the instruments for recording related pressures and levels.

Both the throttling range and automatic reset rate on these Brown Air-O-Line controllers are very conveniently adjustable by means of two calibrated dials, accessible when the case door is opened. These adjustments can be made at any time during operation without taking the control out of service and the only tool required is a small screw-driver.

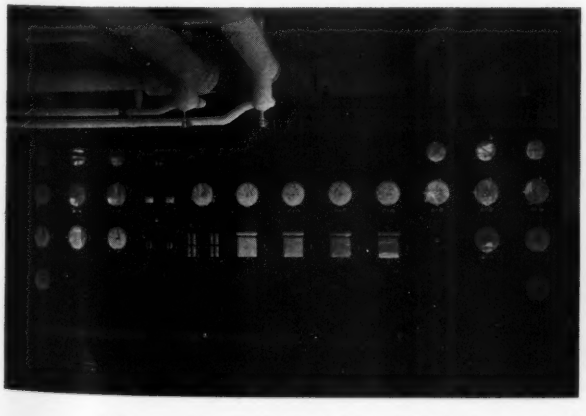
> An outstanding safety record was made for construction work of this magnitude. The old superstition that one life is lost for each $1,000,000 of construction work, was thoroughly disproved. No lives were lost, and no serious injuries occurred. Nor were there any accidents involving claims for property damage, public liability, or rigging risks.

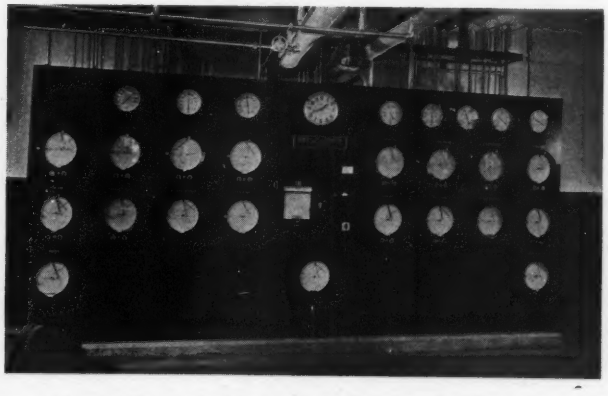
The ease with which these air-operated controllers were "tuned-in" on their individual applications is understood to be one of the important factors in bringing these large units on stream with such ease and also the closeness of control that was obtained right from the start was instrumental in enabling the operators to maintain the units on stream for the extended period of the initial runs.

Several innovations in instrumentation were worked out by the instrument engineers responsible for this job. The first of these was in connection with level recording in 14 towers and 6 receivers. These levels were recorded on the board by the very practical expedient of connecting a pressure pen, mounted on a related flow recorder, into the air line running from the pilot valve of each float type pneumatic level controller to its respective diaphragm valve. The air pressure on the diaphragm is a direct indication of the extent of valve opening and this in turn is directly related to the level in the vessels to which these valves are connected. The operators have been familiarized with this relationship so that the recorded pressure readings can be interpreted in terms of liquid level.

Another new idea that has worked out very nicely is the use of a standard pneumatic type remote manual control unit to accurately and conveniently position the control index on certain Air-O-Line controllers, the control settings of which are quite critical due to process characteristics. This is accomplished by having the control index connected by a linkage to a pneumatically operated spring-loaded bellows. The air pressure on this bellows is regulated by the dial-type manual control station. The operators like the idea because it is unnecessary for them to open the instrument doors to make a control setting adjustment.

All important diaphragm motor valves are equipped with Brown valve positioners to insure a positive valve movement on small pressure changes transmitted from the controller, regardless of any change in valve stem friction thus rounding out the sensitivity and responsiveness of the complete control system.





Left, control panel for Polymer and H_2S units. Right, control panel for stabilizer and debutanizer units.

Removal of H_2S From Gas by The Shell

Tri-Potassium Phosphate Process

By J. M. Mullen,
Shell Development Co.

Among the many units installed by the Richfield Oil Corp. in its recent refinery expansion at Watson, Calif., is a hydrogen sulphide removal system. The plant was fabricated and erected by C. F. Braun & Co., from plans based on flow diagrams furnished by the Shell Development Co. The tri-potassium phosphate process used is licensed under patents assigned to the Shell Development Co.

Feed to the plant is composed of a mixture of paraffins and olefins up to and including butanes contained in the overhead from the gasoline stabilizer unit. Substantially all available butane is contained in the gas. From the hydrogen sulphide removal unit the gases pass to a U. O. P. catalytic polymerization plant. The treat was designed to reduce 3,500,000 standard cubic feet per day from an initial content of 3,000 grains per hundred cubic feet to 100 grains per hundred cubic feet. Operating temperature and pressure assumed for design were 185° F. and 200 pounds gauge, respectively.

It is evident from the flow diagram that the plant is extremely simple in design and operation. Absorption is accomplished principally according to the reaction:

$$K_3PO_4 + H_2S \text{——} K_2HPO_4 + KHS$$

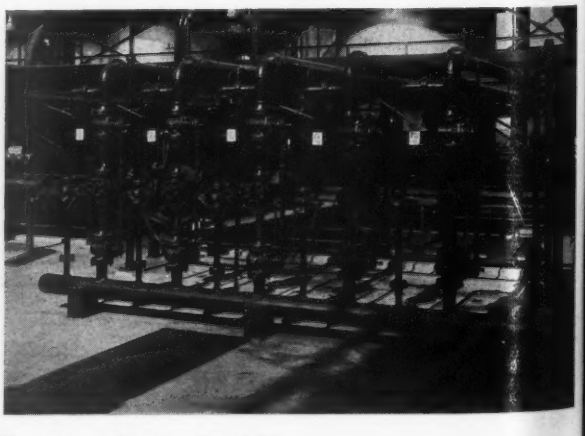
The reaction is reversed during regeneration. Mercaptans are not removed by the phospate process. Ammonia, when present, is absorbed by the solution and is driven off along with the hydrogen sulphide. Gases enter the absorber at the bottom, rise through 36 bubble plates countercurrent to a stream of descending absorbent solution, and pass out at the top. The absorbent is tri-potassium phosphate solution containing 2.0 gram mols K_3PO_4 per kilogram of solution. It was mixed at the site from steam condensate and commercial grades of potassium hydroxide and phosphoric acid in such proportion that the mol ratio of KOH to H_3PO_4 was between 2.95 and 3.00 to one. From the absorber the foul solution is released by level control to the regenerator. Regeneration is accomplished by concentrating the solution in a standard steam heated boiler. The concentrated solution falls to a surge tank where residence at the boiling temperature causes further regeneration. The solution pump picks up the regenerated solution and pumps it back to the absorber by way of the heat exchangers and a solution cooler. Vapors, hydrogen sulphide and steam pass overhead from the reboiler to a condensate stripper which is a small two-plate bubble cap column surmounted by a condenser and a phase separator from which water is refluxed to the stripper. H_2S goes overhead to a waste products burner. Stripped condensate is returned to the top of the absorber by the condensate pump.

This plant utilizes one interesting feature of the phosphate system. The equilibrium solution saturation, expressed as mols H_2S per mol K_3PO_4, corresponding to a given concentration of H_2S in the hydrocarbon, is greater for a dilute solution than for a more concentrated one. Advantage is taken of this fact by doing the bulk of the stripping with a concentrated solution in the lower section of the absorber and using a dilute solution to remove the last traces of H_2S in the upper section. The dilute solution is made up of all the condensate and a portion of the regenerated K_3PO_4 measured by a Fisher & Porter Rotameter.

In the Richfield plant the absorber is 48 inches in diameter and contains 36 bubble plates, spaced 18 inches apart, and one demister tray.

Equipment was designed for peak load; wide fluctuations in gas rate and H_2S content justify the seemingly large number of plates. The concentrated solution enters at plate 18. Heat exchangers, cooler, and condenser are of the conventional shell and tube design. The reboiler has a tapered shell 36 inches maximum diameter by 17 feet long. An overflow weir is formed by connecting the discharge line on the end of the shell. The surge tank is 60 inches diameter by 16 feet long. A six-inch insert in the suction line to the solution pump permits settlement of any suspended matter. Solution concentration may be regulated by bleeding open steam to the surge tank or by withdrawing condensate at the stripper. The condensate stripper and phase separator are both contained in a 36-inch diameter shell. They are separated by a solid deck but connected externally by a reflux leg. Bubble plates of the stripper are similar in construction to those of the absorber. Pumps are of the steam driven double acting reciprocating type furnished by Union Steam Pump Co. Duplicate pumps are provided. As the solution is not corrosive, iron and steel are used throughout. Every possible convenience for operation and maintenance has been provided. The absorber and condensate strippers have manholes at each plate. Platforms and overhead trucks were installed to facilitate handling and inspection of heat exchanger bundles. Control of the plant is almost entirely automatic.

Gas is available for processing at 175 pounds gauge pressure and 150° F. The initial H_2S content varies between 2000



Powell valves to the left and Chapman valves to the right.

to 2500 grains per 100 cubic feet; mercaptans, calculated as equivalent H_2S, from 100 to 250 grains per 100 cubic feet. The volume of gas also ranges from 2,000,000 to 3,000,000 cubic feet per day, depending upon cracking and reforming operations. At normal full load the total flow rate of regenerated solution is 40 G.P.M., of which 3.0 G.P.M. is released to the dilute solution stream. The condensate rate is 5.0 G. P. M. making approximately 8.0 G.P.M. of dilute solution. The initial charge contained about 4000 gallons of 2.0 mol K_3PO_4/kg. solution. Heat is supplied by steam from the high pressure system at 140 pounds gauge pressure; the normal rate is 3000 pounds per hour. To avoid any possible hydrocarbon condensation, the solution is fed to the absorber at temperatures slightly higher than the gas stream. Heat exchange has been excellent thus far, and it has been unnecessary to use the solution cooler. The cooling water rate to the condenser is 250 G.P.M.

For plant control, gas analysis is performed by the Tutwiler method, using standard iodine solutions with starch as an indicator. Solution concentration is checked by measuring Baume gravity with standard hydrometers. The Tutwiler titration does not distinguish between hydrogen sulphide and the lower mercaptans. As the mercaptan content of the gas is not constant, laboratory checks are made at regular intervals to determine the true H_2S content of gas before and after treatment. A potentiometric method of titration which distinguishes between H_2S and mercaptans is used. This procedure was devised by the Shell Development Co. laboratory and will be described in a separate publication. As determined by such potentiometric analysis, the H_2S content of the treated gas has been consistently in the range of 50 to 100 grains per 100 cubic feet. Periodic analyses are also made of the chemical content of the absorbent solution.

Solution loss is a negligible item. K_3PO_4 is a stable, nonvolatile salt; it enters into no side reactions and introduces no impurity in the treated gas. A drip collecting system has been installed which picks up the leakage at the packing glands of the solution pump and the samples withdrawn for gravity determination.

The plant was placed on stream early in October. Operation has been uneventful except on one occasion. The difficulty was overcome by a slight modification of the flow plan. Suspended material, principally iron sulphide formed from mill scale, accumulated in the solution during early operation. However, when the solution was withdrawn and the plant flushed with hot water after ten weeks of operation, there was no noticeable corrosion in any part of the plant.

A typical daily operating statement, supplied from Richfield records, appears in the table below. Were the cost of steam generation a matter of primary importance, steam consumption could be reduced about one-third by stripping the solution with open steam.

Richfield Oil Corporation H_2S Plant — Daily Report

24 Hrs. Ending 7 A.M.
December 27, 1938

Gas Rate—Std. Cu. Ft./Day	3,060,261	
Inlet H_2S—Grains/100 Cu. Ft.	2,150	(a)
Outlet H_2S—Grains/100 Cu. Ft.	186	(a)
H_2S Removal—%	91.5	
Lbs./Day	8591	
Steam		
To Concentrator, #/Day	91,550	
To Surge Tank, #/Day	.....	
Total, #/Day	91,550	
Lbs./Lb. H_2S Removal	10.7	
Strong Solution, Gal./Day	57,600	
Gal./1000 Cu. Ft.	18.8	
°Be′	49.5	
Foul Solution, °Be′	46.0	
Weak Solution		
Strong Sol. Gal./Day	3,499	
Cond., Gal./Day	7,200	
Weak Sol., Gal./Day	10,699	
Gal./1000 Cu. Ft.	3.5	
Be′	19.7	

AVERAGE OPERATING CONDITIONS

	Temp. °F.	Press.
Gas to absorber	149	.....
Absorber Top	182	.....
Bott.	169	169#
Strong Sol.	183	.....
Weak Sol.	200	.....
Concentrate	242	.....
Surge Tank	240	1/2#
Accumulator Top (H_2S Rec.)	88	.....
Bott.	212	.....

(a) Includes mercaptans.

(*Continued from page* 16)

Production data: when the new company was formed actual production was 17,000 barrels daily, with 3,000 barrels shut in. On January 1, 1939, actual daily output of Richfield properties was 21,959 barrels, with 34,041 barrels shut in. During the period from March 12, 1937 to the end of that year, the company drilled 60 wells. In 1938 the company drilled 66 wells. Accumulated initial production from the 1937 wells was 19,868 barrels. Accumulated initial production from the 1938 wells was 30,670 barrels. Gross 1937 production was 5,511,000 barrels, and gross 1938 production was 7,719,000 barrels.

The story of Richfield's continuous search for the ideal motor fuel is as long as the service of Kelley, Panero, Dave Day, and several others who are still with the corporation. Before 1925 Richfield gasoline was a blend of straight run gasoline, to which was added a light casinghead gasoline. At times it was necessary to import this casinghead from the Mid-Continent at prices ranging as high as 27 cents a gallon.

In 1925 Richfield developed a new cracking process and reconstructed the refinery at Hynes. The new process made it possible to raise the octane rating from 62 to 65 by blending the new cracked gasoline with casinghead and straight run gasoline. In 1932, the Lachman process for treating cracked gasoline prevented depreciation in anti knock value. This was the original Hi-Octane gasoline produced by Richfield. It was made up of 15 per cent casinghead, 55 per cent straightrun, and 30 per cent Lachman treated cracked gasoline. The octane number was 70.

Dick Montgomery

In 1933 the octane rating was further raised up to 71 by adding tetraethyl lead, or "Q" fluid, to Hi-Octane gasoline, to meet the requirements of the new engines, which by this time had been raised to about 6 to 1 compression ratio.

Since 1933 the Richfield research laboratory has literally made hundreds of experimental blends endeavoring to improve the anti knock performance of Hi-Octane. All of these blends were tested in the laboratory and on the highway, and it was during these tests that Richfield engineers discovered several important facts

E. C. Herthel, Sinclair's manager of development and research, discusses plans with E. W. Isom, right, vice-president of Sinclair and noted inventor.

Setting up the traveling laboratory to test gasoline performance on the road.

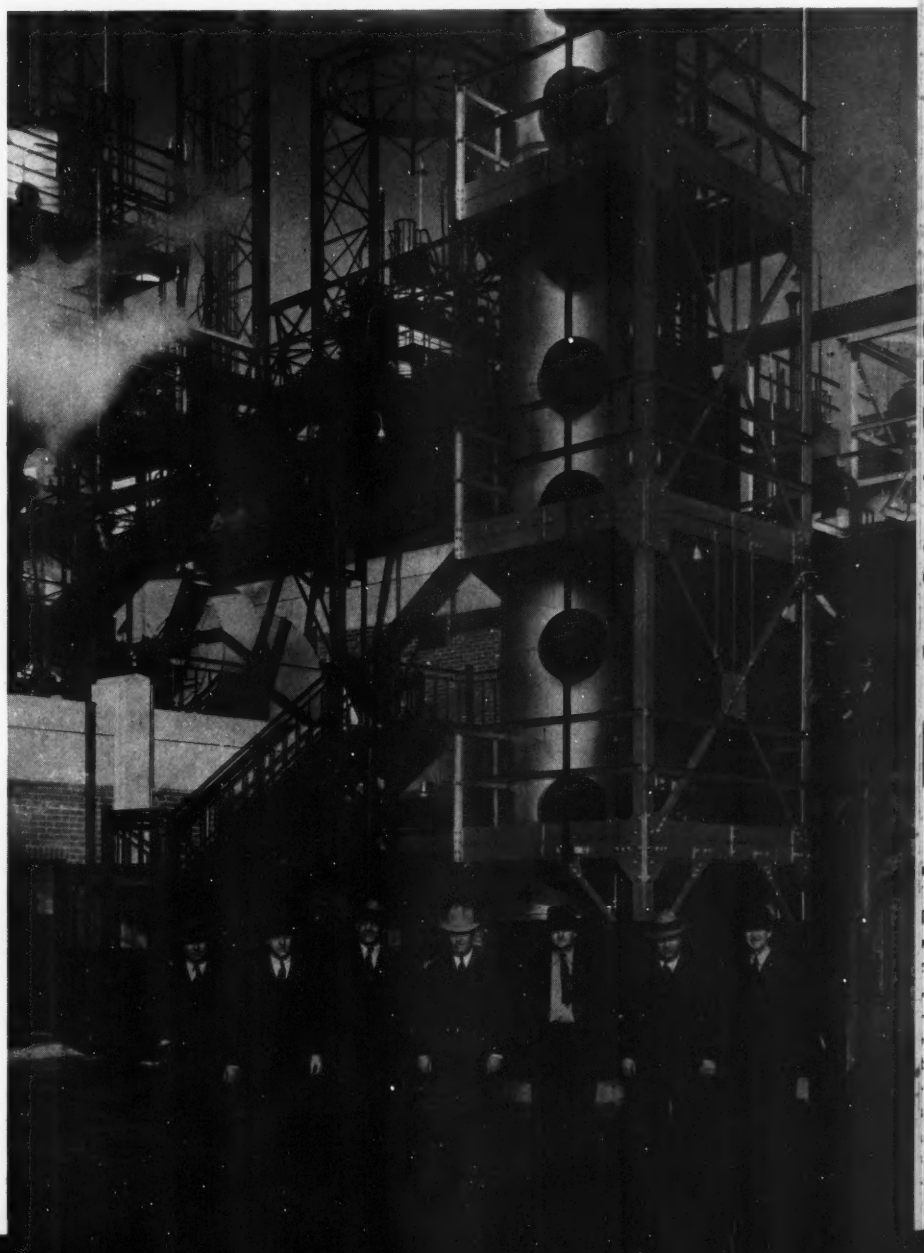
Albert M. Kelley

Dave Day

requirements of Richfield's ambitious plans. These were not ordinary blends of casinghead, straight run and cracked gasolines. Six important factors had to govern:

First, the fuel must contain stabilized natural casinghead gasoline to provide easy starting and short warm-up period, with no vapor lock during hot summer driving or at high altitudes. Second, it must contain straight run gasoline for smooth high speed performance and power on the hills, with sustained antiknock value at high and low temperatures. Third, it must contain cracked gasoline for outstanding city performance and for a high anti knock rating at all speeds. Fourth, it must contain a brand new product, cracked stabilizer bottoms. This cracked casinghead is made from the light gases of the cracking process. New equipment had to be designed to convert these light gases into a liquid. It was found that this light gasoline had a very high octane rating. Fifth, it must contain still another new product, polymerized gasoline, a fuel which increased the anti knock performance of the crack-

Richfield Oil Corp. manufacturing department: Supervisory personnel, Watson refinery, with absorption tower, portion of control room and de Florez heaters in background. Left to right: H. V. Goza, foreman maintenance department; W. C. Farquhar, refinery engineer; R. A. Panero, superintendent Watson refinery; C. R. McKay, manager of refineries; L. F. Strader, foreman combination units; Frank Fontana, resident engineer, and W. R. Davis, assistant superintendent Watson refinery,



which had been overlooked by the industry in general. They found that although several gasolines tested the same in the C.F.R. knock testing engine, there was a wide difference in their anti knock performance value in actual operation. Some gasolines seemed to perform satisfactorily at low speeds, but were not smooth and quiet at high speeds. Other gasolines were good highway fuels, but unsatisfactory for city driving. Richfield then began "road testing" in earnest. The road performance of some of the experimental blends was outstanding, but these gasolines could not be made in sufficient quantities with present refinery facilities to meet the

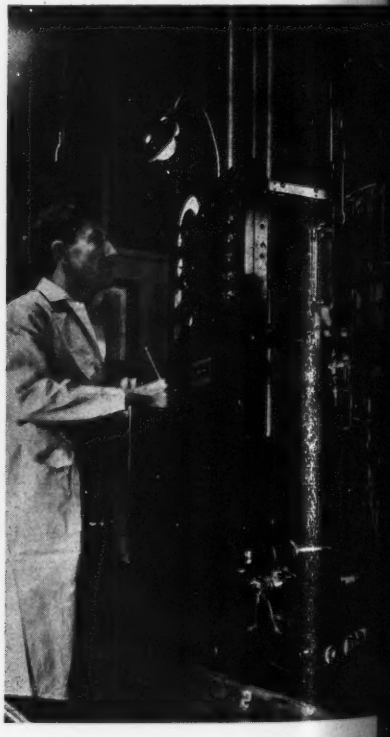
Above are some of the gadgets which tell how a gasoline agrees with an engine.

ed gasoline much the same as tetraethyl lead improves the octane number rating of a straight run gasoline. Sixth, it must contain tetraethyl lead, which raises the anti knock value of all five blends for high speed or full throttle operation.

Richfield's refinery engineers had developed an experimental motor fuel meeting these requirements. When cost estimates for a refinery capable of producing this gasoline in the desired quantities was completed, it was found that more than $5,000,000 would be required.

Shortly before this torrid scene, these two engineers were testing gasoline on snow covered mountain heights. Southern California provides any kind of weather and altitudes ranging from sea level on up.

Octane rating by the C. F. R. method.



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OLEUM
1939

Field Development

San Joaquin Valley

West Coalinga Wild Cat Assured

Trying for new production west of the est Coalinga field, Roco Oil Co. is gging up Lindblom No. 1 in sec. 3, -14. The project's reported location is 0 ft. north and 150 ft. west of the utheast corner of the northwest quar- of sec. 3.

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ole's Levee Test ores Stevens Oil Sand

Ohio Oil Co. KCL F-2 in sec. 10, 31- north of the discovery well KCL No. 1, of the Cole's Levee Area, is report- as being in oil sand with top of the cond zone at 9330 ft. Still drilling oil sand with bottom below 9500 ft., indications are that good production ll be obtained. Completion will add quarter of a mile northerly to the own productive zone. Standard Oil . continues to make hole in KCL No. -1, one mile to the west of No. F-2. ith more than 8300 ft. of hole, the oject is in hard shale. Bottomed at 0 ft. and near possible production, nion Oil Co. is running an electric gging device in Kernco No. 1-11 in . 11,31-25. Lying one mile east of the own production, the results of the t will determine in part the future of Cole's Levee Area. Richfield Oil rp. is holding back on the proposed rtherly area try in sec. 3,31-25. The oject, to be known as Western No. B- 3, is reported as a location only. The st southerly proposed try of the area the location of Tide Water Associated l Co., KCL No. 1 in the northeast arter of sec. 14,31-25.

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rn River Edge ells Produce

At the eastern limits of the Kern Riv- field where the sands are known to ch out to the east, two recent completions proved to be slightly better than average. The area consists of a Homoclinal accumulation dipping to the west and as a consequence the average easterly production is 2½ bbls. of 12 to 14 gravity oil, cutting as much as 85% fresh water. D.B.K. Oil Co.'s well No. 1, completed late in February, was last reported making 5 bbls. of 13 gravity oil cutting only 1.0%. The well, located in sec. 34, 28-28, is producing from 84 ft. of perforated 6-in. casing landed at 338 ft. Adding to the many completions they have made in this area, Helm

SAN JOAQUIN VALLEY WILDCATS

Area	Well	No.	Section	Depth	Status
	Fresno County				
Coalinga	Amerada Pet. Corp., SPL	7–17	17, 19-16	6831	Drilling
	American Oil Fields, Inc.	1	16, 19-15	250	Idle
	Foreign Oil Co.	6	6, 21-15	2485	Drilling
	Jarvis, Leo P.	2	14, 20-14	767	Idle
	Progressive Oil Co.	3	20, 19-15	825	Idle
	Roco Oil Co.	1	3, 20-14		Rig
	Stuart Oil Co., Stuart	1	12, 21-14	1285	Drilling
Jacalitos Hills	Dauphin Dev., Ragan	1	30, 21-14	4587	Idle
	Kern County				
Arvin	Superior-Standard-Texas, Jewett	1	16, 31-29	6270	Producing—Shut-in
	Superior Oil Co., P.D. Jewett	1	16, 31-29		Grade
Buttonwillow	Calif. Explor. Co., Salisbury	1	7, 29-24	11560	Drilling
Canal	Shell Oil Co., KCL	B-87	4, 30-25	11971	Drilling
Coles Levee	Ohio Oil Co.	KCL-F2	10, 31-25	9493	Drilling
	Standard Oil Co.	KCL 20-1	9, 31-25	8228	Drilling
	Tide Water Associated	KCL-1	14, 31-25		Location
	Union Oil Co., Kernco	1–11	11, 31-25	9429	Drilling
Devil's Den	Amerada Pet. Co., Beer	6	21, 26-19	4375	Drilling
	Herzog, Raymond D.	1	27, 25-18	612	Drilling
Edison	Hillview Oil Co., El Tejon	1-A	11, 30-30	2661	Idle
	Renner & R.H.L. Oil Co.	1	27, 30-30	2600	Idle
Elk Hills	Richfield Oil Corp.	A-52-32	32, 30-25	8066	Drilling
Grapevine	Petrol Corp., Reserve	33–5	33, 11-19	8784	Drilling
	Tide Water Assoc. O. Co., S.P. 2		15, 11-19	7326	Testing
Lerdo	Shell Oil Co.	KCL A-23	2, 29-26	8328	Drilling
	The Texas Co.	KCL 35-1	35, 28-26	7898	Drilling
Lost Hills	California Lands, Occidental	2	24, 26-20	5604	Drilling
McClung	Superior Oil Co.	KCL-12	3, 30-26	12981	Drilling
Mt. Poso	Shell Oil Co., Glide	48–29	29, 27-28	2504	Drilling
	Vendome Oil Co.	1	28, 26-28		Rig
Midway	Fried, Julius	1	34, 32-24	5035	Redrilling
Richgrove	Dilamar Oil Corp., Quinn	3	15, 25-27	1310	Drilling
Trico	Standard Oil Co., M.&L.	8–1	3, 25-23	2463	Testing
Union Ave.	Richfield Oil Corp., Union Ave.	1	6, 30-28	10256	Drilling
Upper Kern River	Kern Valley Drlg. Co.	1	4, 29-29		Rig
Wasco	Union Kernco	1–36	36, 27-24	1366	Drilling
	Tulare County				
Richgrove	Amalgamated O. & G., Konda	5	23, 24-27	1012	Abandoned

and Smith have finished H & S No. 12. Located in sec. 34,28-28 the well is producing 7 bbls. of 13 gravity oil cutting 2.0% from 160 ft. of perforations landed at 670 ft. One mile to the northwest, Combs Bros. Well No. 1 is bottomed below 460 ft. in oil sand of the Kern River formations. The well was last reported as setting 8-in. casing.

Calif. Expl. Makes Important Find at Buttonwillow

Topping the first Stevens sand stringers at 11,535 ft. California Exploration Co.'s California Lands-Dougherty-Salisbury No. 1 is now coring below 11,850 ft. The test is located 7 miles southeast of the Buttonwillow gas field 8 miles southwest of the prolific Rio Bravo oil field and but 2 miles north of the town of Buttonwillow, in sec. 7,29-24. California Exploration Co. is being backed in this project by several operators holding hundreds of acres of the potentially rich oil bearing lands surrounding the project. If results of current tests are as successful as indicated, the area will undoubtedly be the second large field discovery of the year. Richfield, with 320 acres in the discovery section, Union, General Petroleum, Getty, Continental, Superior, Shell and other operators, are leaseholders in the immediate vicinity of the strike. The lands surrounding the strike have been prospected six times since 1921, the deepest of which tests was bottomed at 6993 ft.

Twenty-five miles northwest of the Salisbury No. 1, California Lands, Inc., has topped the first Temblor oil sands at 5538 ft. in Occidental No. 2. This test, lying due west of the Lost Hills field in sec. 24, 26-20, has 7-in. casing landed on bottom at 5604 ft. The lower zones are to be tested after which the company will perforate for a test of the upper formations. Occidental No. 1, abandoned at 7343 ft. in the same section, showed oil sands in nonproductive qualities in both the first and second Temblor zones.

Grapevine Driller Again in Basalt

After passing through 1500 ft. of Basalt with base at 8500 ft. into the Jewett silt, Reserve-Petrol No. 33-5 is again in the igneous horizon with top at 8650 ft. Below 8760 ft. the try, located in sec. 33,11-19, is slowly drilling ahead. Four miles to the northeast in sec. 15,11-19, Tide Water Assoc. Oil Co. has set casing. With bottom at 7326 ft., 6-in. casing was landed at 7035 ft. The well, known as S. P. No. 2, has been carefully watched because of its importance as an area test. A production test of the interval 6650-6785 ft. recovered salt water and a little oil.

Jewett No. 1 Discovers Mountain View Extension

Biggest discovery of the year, to date, is the opening of new production south of the Mountain View field by Jewett No. 1, joint exploratory well of Standard Oil Co. and The Texas Co. Completed at 6270 ft. Feb. 24, estimates placed the initial production rate at 3600 bbls. a day, the oil being clean and exceeding 31.5 degrees in gravity. Sustained production rate was 2988 bbls. of oil and 1,400,000 cu. ft. of gas.

Located in the northeast quarter of sec. 16,31-29, a mile south of outpost wells, the new discovery is in an area long suspected of being productive but previous attempts by Union Oil Co., The Texas Co., General Petroleum Corp. and others ended in failure, though several wells developed a small amount of oil. Of some significance is the gravity of the new well's yield which equals the highest found in the field.

Mechanically, Jewett No. 1 is completed with 8⅝-in. casing cemented at 6060

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ft., ten feet above the top of the oil sand, and with a 6⅝-in. perforated liner landed on bottom at 6270 ft.

Unlike many of the newer Valley plays, the Arvin district is divided into many comparatively small holdings; a fact which guarantees the drilling of many wells. That the productive area will in all probability extend westerly is indicated by Union Oil Co.'s Berry No. 1 which found only 25 bbls. a day in the section adjoining to the east. It is assumed that the main control in the new pool will be found to be faulting as in the main portion of the Mountain View field.

Superior Oil Co., which drilled the discovery well on contract for the joint operators, is preparing to drill P. D. Jewett No. 1, on its own account, one location to the south. Other companies are expected to follow suit in the near future.

Canal Test Drills Deep

Still searching for productive oil sands, Shell Oil Co.'s KCL No. B-87-4 is drilling in what are reported as Miocene sediments below 12,000 ft. Although information has been meager, it is believed that the Vedder zone has not yet been encountered. Location of the test is two miles northwest of the Canal field in sec. 4,30-25.

Shell Drills "2 in 1" Project at Poso Creek

Shell Oil Co. Glide No. 1 in sec. 29,27-28 on Poso Creek is to prospect two separate portions of the 640-acre lease from the same derrick location. In the current Glide test the company reports having encountered the Vedder sand at 2300 ft., and oil showings in the zone from top to 2335 ft. The test is at present bridged at 966 ft. in preparation for a whipstocking operation to prospect the portion of the lease lying northeast of the derrick. The proposed hole will be the third drilled in this section by the Shell Oil Co., the first of which No. 58-29, easterly of the present location, was drilled into the barren Vedder and abandoned with bottom at 2321 ft.

Standard Greeley Well Battles Water Trouble

Standard Oil Co. Fleishauer Comm. No. 2 in sec. 20,29-26 is again troubled by the intrusion of water. On a test of the interval 11,560 ft. to 11,575 ft. the well flowed more than 3000 bbls. gross cutting 76%. With bottom at nearly 12,000 ft. the try has found some oil sand believed to be the Rio Bravo. Indicating a faulted condition, the Standard Elrich Comm. No. 1, located one quarter of a mile northwest in the same section, drilled through the barren Vedder sands based at 11,730 ft. and may be carried to the Eocene formations for the deepest test of this area. Standard's other projects in the Greeley group are at various stages. KCL 12-5 is idle at 5959 ft., KCL 11-17 is drilling in hard gray shale at 9400 ft., KCL 11-16 is in gray sand below 10,500 ft., Ross No. 1 is standing at 8111 ft. and KCL 12-6 is in hard gray shale at 8822 ft.

Gen. Pet. Tests Rio Bravo Well

On a 15-hour test of the interval 11,437 ft. to 11,503 ft. General Petroleum Corp. Van Ness No. 3 in sec. 2,29-25 flowed 1542 bbls. of 37 gravity oil cutting 3.2% with 1,700,000 cu. ft. of gas. The well is deepening below 11,517 ft. The Vedder sands were topped at 11,493 ft. Located east of No. 3, Van Ness No. 2 is reported as a rig. One section to the north in sec. 35, 28-25 General Petroleum Corp. Caldwell No. 1 is bottomed below 10,000 ft. in shale. Two miles northwest of the Caldwell try, Superior Oil Co. is rigging up a new project to be known as Moodie No. 1. Location for the well is given as 293 ft. north and 293 ft. east of the southwest corner of sec. 28.

Amalgamated Abandons Richgrove Wildcat

Amalgamated Oil and Gas Co. reports abandonment of Konda No. 5 at Richgrove. The try was drilled to 1912 ft. in slate topped at 1910 ft. Finding the expected formations barren, the company has moved out the portable outfit with which the work was done.

New Tests At Round Mountain

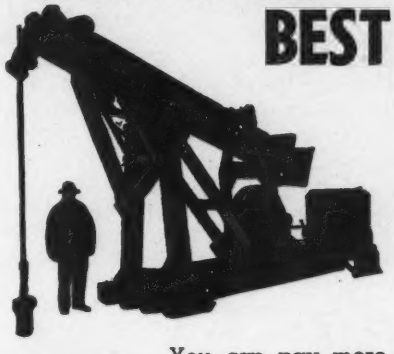
California Western Oil Co. is rigging up an old idle rig known as No. 12 in sec. 12, 28-29 for new tests of the area. C.C.M.O. Co. is preparing to spud a well to be known as No. 1-31 in sec. 31,27-29., located 1039 ft. north and 2508 ft. east of the southwest corner of the section. Elevation was given as 1018 ft. Crestmont Oil Co. is rigging up Coffee No. 1 in sec. 8, 28-29.

Location has been chosen for Kelly No. 2 by the Grizzly Bear Oil Co., in the southwest quarter of sec. 6, 28-29. Production may be found here in the Jewett Silt, the Pyramid Hill Sand or the Upper Vedder Sand. Tests have proved that the Lower Vedder and the Walker formations are wet.

Standard Tests Trico Well

Encouraged by the recent completion of a gas pipe line outlet by the P. G. & E. by which heretofore shutin wells are able to produce, Standard Oil Co. ran a test on M & L No. 8-1. During the test, from 2403 ft. to bottom at 2462 ft., the well flowed 6,896,000 cu. ft. of gas through 1½-in. bean. One mile to the east Trico Oil and Gas Co. T & G No. 1 is building rig.

CALIFORNIA'S BEST



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Los Angeles Basin

Torrance Hot Spot At Peak Activity

With 25 wells drilling, many preparing to spud, and completions averaging one a day, the current Torrance "Hot Spot" is now at the peak of its activity. Although field limits were not extended during the past fortnight, the good production found in Deep Hole Drilling Co.'s well at 240th and Walnut Sts. was shown to be no freak by the completion of J. E. Pettijohn's Adele Oil Co. No. 1 across the street to the north. With 390 ft. open to bottom at 5160 ft., Adele No. 1 initialed over 700 bbls. of clean oil daily. Two wells developed production east of Walnut Ave.; both at the intersection of 237th St. Largest of the pair was L.M.S. Oil Co.'s Kettler No. A-1 which established a rate of 900 bbls. in 18 hours. D. W. Elliott, after deepening the old Shell Oil Co. Kettler No. 10, obtained a yield of 660 bbls.

Requiring an elapsed time of only 13 days from spudding to completing, Alford Development Co. established a new speed record for the field. Located on Walnut north of 237th St., production of the well is low, approximately 150 bbls. a day.

At the northeast corner of 238th St. and Eshelman Ave., W. E. McCaslin finished Springman No. 1 flowing 375 bbls. with a cut of 3.5%. Late reports indicate the water content increased to more than 10.0%.

Future extension of the area to the south and east depends on the findings of Ray W. Wilson's No. 3, located east of Walnut and 800 ft. south of Deep Hole's No. 1. At 5100 ft. a fair quantity of oil sand had been encountered.

On its large Marble Fee lease, Pacific Western Oil Co. deepened No. 12 to 4930 ft. where it produced initially 250 bbls. a day on the pump.

Bankline Completes Rosecrans Project

Injecting new life into lagging Rosecrans Bankline Oil Co. completed its southeast edge well, Kirby No. 2 flowing at the rate of 775 bbls. a day, clean. The O'Dea zone is open at intervals below the shoe of the 7-in. casing at 7550 ft. to bottom at 7700 ft.

One location to the south of the important new well, Metcalfe Oil Co. is drilling its Rosecrans No. 1 below 6850 ft. on property subleased from Bankline.

Howard Oil Associates' outpost well on Compton Blvd. is reported to have passed the 5400 ft. level.

Superior Oil Co. finally completed its Maxwell No. 12 pumping 340 bbls. after reperforating the 6⅝-in. liner from 7490 to 7510 ft. The production is cutting less than 3%.

Bottomed at 7735 ft., Union Oil Co. Rosecrans No. 28 flowed initially 675 bbls. but has been beaned back to under 400 bbls. No. 31 on the same lease is drilling below 5000 ft.

On its large Trust lease, Universal Consolidated Oil Co. is completing its No. 10. Total depth of the hole is 7757 ft. and casing has been cemented at 7485 ft.

Royalty Service Co. is preparing to drill Gordon No. 4 in the southwesterly portion of the field.

Olympic Flows Two Montebello Zones

Pioneering multi-zone completions in the West Montebello field, Olympic Refining Co. brought in Smith Comm. No. 1 flowing a total of 725 bbls. a day. Bottomed at 7137 ft., the Fourth Finger of the Sixth zone is open from 6650 to 6700 ft. while the Seventh zone is open below 7025 ft. Both horizons are clean; the initial production being 325 bbls. from the upper and 400 bbls. from the lower. It is understood that the yield has been cut to a total of 600 bbls.; 300 bbls. from each interval. Although mechanical details of the unusual completion have not been revealed, it is probable that the arrangement is similar to that in use at Wilmington where tubing is run to the lower perforations and the upper zone circulated "in" before setting a packer between the zones and swabbing the second.

With the Seventh zone ice definitely cracked in the middle of the thickly drilled Maple Ave. area, it will be only a short time before many wells are producing it. Already Herley-Kelley's Burke Comm. No. 2 has made a successful formation test in the deep sand and is preparing to complete as is McVicar & Rood's deepened Manz No. 1. These wells bottomed respectively at 7230 ft. and 7240 ft. To protect their leases, other operators will shortly be forced to follow suit.

In the hope of discouraging Seventh zone development at present, Union Oil Co. previously had completed Calkins No. 1 in the lower Sixth from the interval 6630-6688 ft. after a formation test revealed the deeper horizon capable of substantial production. The initial 1200 bbl. rate has been beaned back to 300 bbls. a day of clean oil. A second easterly well was completed by Union when Paul Howard No. 4 was swabbed in flowing 685 bbls. through a 22/64 in. bean. A 43 ft. interval is open to 6695 ft. One location to the east, Union's Wilcox No. 3 flowed 1200 bbls. cutting 10% on a formation test with bottom at

LOS ANGELES BASIN WILDCATS

Area	Well	No.	Section	Depth	Status
Bellflower	Clayton, Geo. L., Scott	1	32, 3-12	6897	Idle
Castaic	Royal Land Corp.	1	8, 4-17	1338	Idle
Kraemer	Congress Oil Co.	2	36, 3-9		Foundation
La Mirada	John McKeon and Assoc. Carmenita	1	21, 3-11	8980	Testing
Mojave	Mojave Pet. Co., Gorman	1	5, 8-18	510	Idle
	Jennings	2	33, 5-14	520	Idle
Newhall	Mangrum and Page, Lintz	1	4, 3-15	150	Idle
	Newhall Drlg. Asso., Needham	4	13, 3-16	3505	Idle
	Palmluck Oil Co.	1	23, 3-16		Rig
Palmdale	Neu-Cal	1	17, 6-12	1250	Idle
Palos Verdes	Rolling Hills Pet.	1	27, 4-14	5385	Idle
Playa del Rey	Treasure Oil Co.	9	34, 2-15		Foundation
Santa Monica	The Texas Co., A-S	1	9, 2-15	7336	Redrilling
San Pedro	Grady, R. T.	1	23, 5-14	650	Idle
Torrance	Blackstone Oil Co.	1	2, 4-14		Foundation
Whittier	Langstaff, Geo. W., Iliff	1	8, 2-11	2250	Idle
	H. C. Oil Co., Joyce	1	22, 2-11	3360	Idle
	C. W. Partridge	1	22, 2-11		Rig
	Orange County				
Anaheim	The Texas Co.	A-13-1	8, 4-10	8250	Drilling
Bolsa Chica	New Fields Oil Co.	1	16, 5-11	4180	Idle
	Patos Drilling Co.	1	21, 5-11	5429	Idle
Costa Mesa	A. V. Oil & Gas Co.	1	16, 6-10	4751	Idle
	San Bernardino				
Carbon Canyon	Carbon Canyon Oil Co.	1	30, 2-8		Rig
Chino	So. Counties Pet. & Drlg. Co.	1	22, 2-8	2830	Idle
	San Diego County				
Carlsbad	Dauphin Dev. Co., Kelly	1	16, 12-4	1201	Idle

6700 ft. Paul Howard No. 4 and Wilcox No. 3 are the most southerly wells in the easterly section of the new development.

With initial gauges at the rate of 45 bbls. per hour, Pongratz Petroleum Co. brought in Newmark No. 1 extending production west of Standard Oil Co.'s Braun lease. Hole was bottomed in the lower Sixth at 6710 ft. Present flow is reported as 300 bbls. of 36 gravity clean oil and 1,000,000 cu. ft. of gas. Braun No. 2 was completed by Standard flowing only 300 bbls.

In the northeasterly section, The Texas Co. set casing in Mulholland No. 5 after a formation test indicated the middle Sixth zone capable of clean production. Traders Oil Corp. has spudded its offset to the Texas well.

Proving that the cross fault limits deep production to the east, Union Oil Co.'s La Merced No. 30 has encountered only gray sand to last reported depth of 7550 ft. The drilling is being continued in hope of finding something new.

New completions in the deeper zones have materially increased production, the West End total for March 1 being nearly 9,000 bbls. against a daily quota of 5,000 bbls. for the month of February.

Dominguez Test Below 9500 Ft.

Coring gray sand and shale, Shell Oil Co.'s deep test of the Dominguez Hill field was last reported below 9500 ft. Several hundred feet of oil bearing sands and shales were passed through below 8000 ft. but no production tests were made, the intention of the company being to carry the hole down in search of new sands. The well, known as Reyes No. 97, is located south of present production on the theory that the structure is asymmetrical with the deeper axis to the south.

Gen. Pet. Spuds Los Olivos Well

With the drill now at 875 ft. in the hard shale formations characteristic of the area, General Petroleum Corp. has spudded in it's Chamberlain No. 1 wildcat in sec. 12, 7-31 near Los Olivos. Surface casing was set at 205 ft.

Patos Suspends Bolsa Chica Test

Failing to find oil sand in its Bolsa Chica wildcat, Graham No. 1, Patos Drilling Co., suspended operations at 5429 ft. The well is located on the topographic high point midway between the Seal Beach and Huntington Beach oil fields.

Anaheim Wildcat Fishes Drill Pipe

Stopped by a twist-off at its most interesting stage, The Texas Co.'s wildcat west of Anaheim in Orange county is still fishing for drill pipe. Several hundred feet of shale streaked with poorly saturated oil sand have been cored to bottom at 8250 ft. but formation tests have not yet revealed anything commercial. Similar sands were cored in other wells drilled in the area.

Gen. Pet. Completes Torrance Extension Well

General Petroleum Corp. completed Poggi No. 13, located at the northeast corner of Vermont and Lomita Blvd., flowing at the rate of 300 bbls. a day. Preparations are being made to drill Poggi No. 14, 850 ft. east of the same intersection.

The Texas Co. is preparing to set water string in Oakley No. 4 and is grading a location for No. 5.

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Five Points Awaits Dragon Completion

Activity in the Huntington Beach Five Points area is at a standstill awaiting the result of a production test being made in Dragon Oil Co.'s Jauman No. 1. With bottom at 4624 ft. and with 8⅝-in. water string cemented at 4557 ft., a liner has been run and the well is being readied for the pump. Ready to start if good production is obtained are Gunnar Eriksson, Booth Oil Co., Reid Petroleum Corp., Consolidated Petroleum Co. and others.

Within the old field, The Texas Co. is preparing to complete Brown No. 10 which has been plugged from 3784 to 3470 ft. A 685-ft. liner was landed on the plug and a test is being made of the interval 2840-2930 ft. before gun-perforating the lower horizons.

Wilshire Oil Co. recompleted two ocean front wells, Nos. 2 and 15, each pumping about 300 bbls. Both were redrilled and deepened to the 5400 ft. level. Southwest Exploration Co. State No. 8 was completed at 4375 ft. with initial production of 370 bbls. cutting 6.0%.

Gato Ridge Outpost Fails to Flow

Magenheimer No. 5, Barnsdall Oil Co.'s Gato Ridge outpost, failed to flow on a recent production trial. Bottomed at 4385 ft. and with 10¾-in. casing cemented at 2300 ft., a perforated liner was landed and the fluid bailed to 800 ft. During the test only a small amount of oil was in evidence. A late report that smaller drill pipe was being made up indicated that further work was planned for the well.

Carpinteria Well Recovers Drill Pipe

Recovering a drill pipe fish lost on bottom at 1740 ft., Western Oil Royalties, Ltd. is cleaning out to core ahead in Bryce No. 1. The well, which is located in the westerly outskirts of Carpenteria, appears to be rather low structurally, the bottom being yet in alluvial formations.

Barnsdall R. S. F. 5 Tops Oil Horizon

Barnsdall Oil Co. encountered the top of the oil sand at 6379 ft. in its fifth well in its private oil field west of Newhall. An 8⅝-in. water string has been cemented at 6360 ft. preparatory to coring into the zone. Rancho San Francisco No. 5 will be carried to approximately 7200 ft.

McKeon Well Still Testing

After testing several intervals below 7500 ft., John McKeon & Associates deepened Carmentia No. 1 from 8962 ft. to 8980 ft. where more production tests are being made. The well is located in sec. 21,3-11, near La Mirada.

Clark Bros. Executive Back From European Trip

J. B. O'Connor, vice president and director of sales of Clark Bros. Co., Olean, N. Y., has just returned from a two-month trip abroad during which he visited the various Clark offices and representatives in Europe and the Near East.

Much of Mr. O'Connor's trip was made by air, and it included one rather exciting flight of 425 miles over water, at night, in a plane after it had lost its radio antennae and had damaged one wing in an accident incurred while landing at Castelrosso, off the coast of Turkey, for refueling. The pilots decided the damaged plane could safely make the final hop to Tripoli, took off with four passengers, three Englishmen and Mr. O'Connor, and completed its trip.

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Coastal District

Hartman No. 7 Jinx of Ventura Ave. Field

In a field where at best drilling is costly, British American Oil Producing Co.'s No. 7 on the Bolsa Chica Oil Co. Hartman lease seems determined to set a new record. Spudded November 9th of last year, the well is now only slightly below 7200 ft., approximately 1500 ft. short of its final goal. Many difficulties have beset the well including the customary number of fishing jobs and the loss of mud circulation common at Ventura Avenue but the most trouble has been encountered in keeping the hole in its prescribed course. After reaching a depth of 6615 ft. in December, it was necessary to plug back to 4300 ft. and redrill. Thirty-five whipstocks are said to have been used to date in order to keep the recalcitrant hole on the straight and narrow. The well was spudded on the results of General Petroleum Corp.'s Barnard No. 18. which completed last fall at 8410 ft. flowing at a 1600 bbl. rate.

In the same section of the field, Alliance Petroleum Corp. is drilling Hisey No. 3 at approximately 5500 ft.

With its activity largely on the Lloyd lease, Tide Water Associated Oil Co. is running 8 strings of tools, new wells being started as fast as the drillers are completed. Shell Oil Co. at present is working on only two wells, both of which are redrilling after once passing the 5000 ft. mark.

Lloyd Corp.'s easterly outpost, Well No. 2 is alternately drilling and coring in barren formations below 8300 ft.

Oil Group Rigs Summerland Well

Oil Group, Inc., Hyland No. 1, is being rigged up to drill an interesting test for Sespe production at the west edge of the town of Summerland. The derrick was built several months ago.

East of the old submarine production, on tideland permit No. 17, Garman Oil Co. is drilling in red sand and shale below 1500 ft.

Mud Loss Hinders Arroyo Seco Progress

Loss of circulating mud has become a major problem of the engineers responsible for the drilling of The Texas Co.'s Arroyo Seco No. 1 in Monterey county. After more than a month of drilling, only 1400 ft. of hole has been made. The project is located in sec. 11, 19-5, about 15 miles northwest of King City.

El Rancho Finishes Shiells Canyon Well

El Rancho Oil Co. obtained a second good Shiells Canyon producer in Elkins No. 2 which was finished on the pump with production gauging 160 bbls. a day. The initial cut of 15% appears to be cleaning up. Hole was bottomed at 3158 ft. where a liner was landed which contained perforations below the shoe of 9 in. casing cemented at 3054 ft. In view of the excellent results so far attained, it is believed the company will continue with its development program.

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Two Wells Drill In Rincon Field

Drilling activity in the Rincon field is at present limited to two wells. On the "Steel Island" located several hundred yards offshore, Rincon Development Co. abandoned the old No. 3 hole and is directionally drilling No. 4 below 1200 ft. Men and equipment are taken to the job by boat.

On the uplands back of the beach, Chanslor-Canfield Midway Oil Co. is drilling Hobson No. B-25 below 1000 ft. and is grading locations for two more wells.

Hogan Completes Coring Program

With the recent abandonment of Core Hole No. 3, Hogan Petroleum Co. finished, for the time being at least, its exploration program on the extensive Zabala Ranch in Santa Barbara county. The test holes, all reported to have been located in sec. 33, 9-34, were carried to depths ranging from 1000 ft. to 1300 ft. The company has made no announcement whether or not a deep well will be drilled as a result of information obtained.

Litho Test Below 1100 Ft.

Rhode Island Estate No. 1, Litho Oil Co.'s east edge test of the Capitan field is drilling in hard shale below 1100 ft. No showings have yet been reported, the Vaqueros sand not being expected for several hundred feet. The well is located immediately north of the State Highway and offsets the General Petroleum Corp. Erburu lease which is very prolific in its western portion.

Continental Tests San Miguelito Well

Continental Oil Co. is testing the water shut-off on a 5 in. liner landed on bottom at 7035 ft. in Grubb No. 10 at San Miguelito. The liner is cemented at the top of the perforations which extend from 6330 ft. to bottom.

New attachable funny-face for automobiles sticks out its tongue at motorists who toot the horn too much.

California Crude Oil Production

Two Weeks Ending February 25, 1939

	February Daily Quota	Average Daily Production	Excess
San Joaquin Valley			
Belridge—North	14,580	11,496	*3,084
Belridge—South	1,985	1,152	*833
Buena Vista	16,740	16,232	*508
Canal	4,210	3,980	*230
Coalinga-East (Eocene)	3,499	2,677	*822
Coalinga—East-West	15,891	7,056	*8,835
Coffee Canyon	2,755	3,053	298
Edison	2,430	2,424	*6
Elk Hills	7,560	10,260	2,700
Fruitvale	6,945	6,555	*390
Greeley	2,310	1,921	*389
Kern Front	7,700	7,059	*641
Kern River	5,735	2,571	*3,164
Kettleman No. Dome	56,810	60,129	3,319
Lost Hills	4,255	3,350	*905
McKittrick	3,835	3,747	*38
Midway	41,540	45,270	3,730
Mount Poso	13,315	12,864	*451
Mountain View	8,310	9,070	760
Rio Bravo	7,005	7,533	528
Round Mountain	8,865	8,919	54
Ten Section	8,930	9,396	466
Wasco	625	673	48
Other Fields	2,510	2,577	67
TOTAL	248,340	239,964	*8,376
Coastal Counties			
Elwood	4,525	4,733	208
Rincon	2,930	3,614	684
Santa Maria	5,990	3,058	*2,932
Gato Ridge	2,135	3,400	1,265
Santa Maria Valley	18,990	10,410	*8,580
Santa Paula-Newhall	5,285	5,037	*248
Ventura Avenue	31,555	34,025	2,470
Other Fields	5,570	4,933	*637
TOTAL	76,980	69,210	*7,770
Los Angeles Basin			
Alamitos-Seal Beach	7,210	7,339	129
Brea-Olinda	8,405	5,504	*2,901
Coyote—East	2,835	2,568	*267
Coyote—West	7,810	7,798	*12
Dominguez	19,115	21,250	2,135
El Segundo	3,660	4,000	340
Huntington Beach—New and Old	25,125	28,366	3,241
Inglewood	12,710	13,010	300
Long Beach	42,045	49,104	7,059
Montebello	6,007	5,969	*38
Montebello-West End	5,000	7,617	2,617
Playa del Rey	4,970	5,260	290
Richfield	7,520	7,947	427
Rosecrans-Athens	9,875	14,667	4,792
Santa Fe Springs	27,315	29,070	1,755
Torrance	17,025	21,663	4,638
Wilmington	68,820	84,120	15,300
Other Fields	3,198	3,244	46
TOTAL	278,645	318,496	39,851
STATE TOTAL	603,965	627,670	23,705

*—Shortage.

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E. F. Hallock Dies On Bermuda Return

The many friends of E. F. Hallock, well known among representatives of the automotive and oil industries in California, will be shocked to learn of his recent sudden death shortly after his return to New York from Bermuda. He had been in Bermuda on vacation, and was suddenly stricken with double pneumonia while returning home.

Mr. Hallock, who had on many occasions addressed meetings of California automobile and oil dealers, on behalf of General Petroleum Corp., had attained distinction as the chief automotive engineer for Socony-Vacuum Oil Co., producers and marketers of Mobiloil and other Mobil products. He was an outstanding member of one of the world's largest staffs of petroleum engineers, and possessed the rare ability to give dramatic human interest to highly technical subjects, thus inspiring automobile and oil salesmen with the factual information developed in their manufacturing plants.

Recommending continuance of the special excise taxes on petroleum products, President Roosevelt's budget message estimates that the one cent gasoline levy will produce $210,500,000 in the fiscal year beginning next July 1.

NORTHERN COUNTIES WILDCATS

County	Well	No.	Section	Depth	Status
Monterey	Anderson, A. A., Hillman	1	15, 24-14	4004	Idle
	The Texas Co., Arroyo Seco	1	11, 19-15	1390	Drilling
Santa Cruz	Faria, Joseph Jr.	1	12, 11-3		Location
	Hatcher, Homer	1	8, 9-1		Location
Stanislaus	Santa Maria Pet. Co.	1	34, 1-10	2310	Idle
Sutter	Buttes Oilfields, Inc.	5	1, 15-1		Rig

COASTAL COUNTIES WILDCATS

Area	Well	No.	Section	Depth	Status
Santa Barbara County					
Capitan	Litho Oil Co., Rhode I.	1	4, 4-30	1110	Drilling
Carpinteria	Western Oil Royalties	1	32, 4-25	1746	Drilling
Carreaga	Douglas-Stratton Oil Co.	1	8, 8-33	7238	Pumping
Foxen Canyon	Richfield Oil Corp., Tinaquaic	1	36, 9-32	4612	Drilling
Gaviota	Gaviota Oil Co., Hollister	1	35, 5-33	3215	Idle
Gato Ridge	Barnsdall Oil Co., Mag.	5	9, 8-32	4385	Drilling
	Pezzoni	1	15, 8-32	4494	Idle
Los Olivos	General Petroleum Corp., Chamberlin	1	12, 7-31	680	Drilling
	United Western Oil Co.	1	15, 7-30	3450	Idle
Summerland	Garman Oil Co.	17-1	22, 4-26	1487	Drilling
	Oil Group, Inc., Hyland	1	16, 4-26		Rig
San Luis Obispo County					
Edna	Loma Grande Oil Co., Lewis	1	28, 31-13	2125	Idle
Elk Horn	Calif. Pet. Prod., Irons	1	19, 10-24	1825	Drilling
	Lee, Harry, Defiance	1	7, 32-22	290	Idle
	Newton, S. M., Stafford	1	18, 31-21	710	Drilling
	Western Plains Oil Co.	1	7, 31-21	4010	Idle
Huasna	Hancock O. Co.,Scherer-Dickes	1	30, 12-33	5593	Idle
Paso Robles	Vanguard Oil Co., Clark	1	26, 27-14	4951	Idle
	Epco, Inc.	1	27, 26-13	4695	Drilling
Ventura County					
Ojai	High Mesa Oil Co.	1	16, 4-22	1770	Testing
Red Mountain	Martin, J. W.	3	15, 4-21	1260	Prep. to deepen
Sespe	Drain Oil Co., Cosby	1	14, 4-19	1120	Idle
	Claran Oil Co., Hardison	1	22, 4-20	2940	Idle
	Commander Oil Co.	7-F	13, 4-19	575	Cleaning out
	Merchants Pet., Cochran	8	1, 4-20	1725	Drilling
Shiells Canyon	The Texas Co., Shiells	136	4, 3-19	3070	Pumping
	El Rancho Oil Co., Elkins	2	9, 3-19	3158	Pumping
	Shomy Oil Co., Shomy	1	32, 4-19	80	Drilling
South Mt.	Clipper Oil Co.	1	17, 3-20		Rig
Tar Creek	Section 20 Oil Co.	1	20, 5-19	2540	Drilling
Timber Canyon	Stallings, Senter, Ahlberg	1	24, 4-21	1445	Idle
Ventura	Ventura Drilling Co.	1	10, 3-23	2285	Idle
	Ventura Exploration Co., Sexton	1	30, 3-22	9511	Idle
Wheeler Canyon	P & M Oil Co.	1	24, 4-22		Grade

Pickett Named Member Refinery Waste Committee

S. P. Pickett, of Shell Oil Co., Wilmington, Calif., has been appointed member of the American Petroleum Institute's 1939 Committee on Disposal of Refinery Wastes. The appointment was made by N. E. Loomis, Standard Oil Development Co., New York, N. Y., chairman of the Central Committee on Refinery Technology.

Record Motor Fuel Consumption in 1938

California motorists used more gasoline during 1938 than in any other like period in the history of the state.

While the total for the year was only slightly higher than that of 1937, a new record for the assessment of the gasoline tax was reported by the State Board of Equalization.

The total gasoline tax assessed during 1938 amounted to $51,601,430.04 as compared with $51,584,003.69 during 1937, a gain of $17,426.35.

The new high total was made possible by a gain of 1.09% in the distribution of motor vehicle fuel during December. The board reported the sale of 145,883,008 gallons of taxable gasoline on which a tax of $4,376,490.24 was levied. The tax for the same month of the previous year amounted to $4,329,119.19.

Oil companies reporting sales of more than 300,000 gallons in December were listed by the board with the explanation that resale of gasoline previously taxed and exempt sales to the Federal government or in interstate or foreign commerce accounted for differences between total sales and taxable sales. These companies were as follows:

	Gallons Actually Sold	Net Taxable Gallonage
Aromalene, Inc.	721,809	655,280
Bankline Oil Co.	481,316	None
Belridge Oil Co.	1,537,005	137,931
Brown, Henry, dba Operators Oil & Refining	727,097	727,150
California Oil & Refining Co.	358,085	358,085
Caminol Co., Ltd., The	2,558,330	2,499,145
Century Oil Co.	1,578,813	1,578,320
Chanslor-Canfield Midway Oil Co.	375,905	None
Coline Gasoline Corp.	910,645	None
Cowan Oil & Refining Co.	627,487	None
Del Rey Oil & Gas Co.	577,956	None
Eagle Oil & Ref. Co., Inc.	1,584,673	1,481,310
East West Refining Co.	983,687	983,687
El Camino Refining Co.	1,248,072	1,241,703
Elm Oil Co.	410,989	300,373
El Tejon Oil & Ref. Corp.	887,095	887,095
Envoy Petroleum Co.	823,797	823,797
Estado Petroleum Corp.	2,043,732	2,043,442
Exeter Refining Co.	870,855	870,812
Fletcher Oil Co., Inc.	2,244,541	None
F. R. Long, Inc.	1,648,852	None
General Petroleum Corp.	32,933,456	14,375,718
Gilmore-Dabney, Inc.	474,183	None
Gilmore Oil Co.	6,139,688	283,125
Hancock Oil Co.	4,959,816	3,546,789
Harbor Refining Co.	400,218	400,218
Honolulu Oil Corp., Ltd.	706,562	8,704
Kettleman Oil Corp., Ltd.	301,882	None
Krieger Oil Co.	626,835	626,835
Lomita Gasoline Co.	1,703,200	None
Los Nietos Producing & Refining Co., Ltd.	3,008,805	766,100
Macmillan Petroleum Corp.	3,110,569	2,900,263
Maguire Oil & Ref. Corp.	356,073	363,788
McCallen Refining Co.	850,634	850,634
Meek, Herbert A., dba. Henry H. Cross Co. of Calif.	471,788	None
Mercury Petroleum Corp.	433,224	433,224
Mohawk Petroleum Corp.	4,355,391	3,490,325
Natural Gasoline Co.	385,697	None
Norwalk Co., The	1,871,784	1,470,330
O. C. Field Gasoline Corp.	2,306,523	157,994
O. F. Collinge, Inc.	600,473	None
Olympic Refining Co.	1,368,903	1,096,986
Pacific States Oil & Terms.	2,244,654	2,244,541
Pacific Western Oil Co.	524,739	964
Petrol Corp.	1,570,559	466,700
Petrolane, Ltd.	312,184	203,489
Richfield Oil Corp.	16,713,948	12,208,813
Rio Grande Oil, Inc.	3,532,475	None
Rothschild Oil Co.	725,132	725,132
R. R. Bush Oil Co.	1,281,629	1,062,598
Seaboard Oil Co.	1,466,425	None
Seaside Oil Co.	3,585,111	1,578,065
Shell Oil Co.	29,547,022	16,198,821
Signal Oil & Gas Co.	1,405,857	None
Signal Oil Co.	5,510,775	None
Socal Oil & Refining Co.	885,990	883,605
Standard Oil Co. of Calif.	63,856,916	20,488,057
St. Helens Pet. Co., Ltd.	1,290,525	1,290,458
Sunset Oil Co.	2,581,468	None
Superior Oil Co.	2,094,414	110,456
Texas Co., The	12,066,503	7,818,172
Tide Water Asso. Oil Co.	21,722,032	11,893,744
Triangle Oil & Ref. Co.	633,966	633,966
Union Oil Co. of Calif.	26,281,631	13,152,958
West Coast Refining Co.	399,041	None
West. States Gasoline Corp.	3,742,536	180,636
Wilshire Oil Co., Inc.	9,132,914	8,429,842

Legislation from the five far-western states and Congress will be analyzed during the next few months by the California Oil and Gas Association.

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Oil Men's Calendar

C.N.G.A. Meeting First Thurs. Each Month.

March

22-24—American Association of Petroleum Geologists, 24th Annual Meeting, Skirvin Hotel, headquarters, Oklahoma City, Okla.

April

3-7—American Chemical Society, Baltimore, Md.

24-29—Oil World Exposition, Inc., Houston, Texas.

11—AMERICAN PETROLEUM INSTITUTE, DIVISION of Production, Pacific Coast District, Biltmore Hotel, Los Angeles, Calif.

24-29—Oil-World Exposition, Inc., Houston, Tex.

26-28—American Institute of Mining & Metallurgical Engineers, Open Hearth Conference, Cleveland, Ohio.

May

3-5—Natural Gasoline Assn. of America, Tulsa, Okla.

9-11—American Institute of Chemical Engineers, Akron, Ohio.

15-18—AMERICAN PETROLEUM INSTITUTE, 9th Mid-Year Meeting, Roosevelt Hotel, New Orleans, La.

21-25—National Assn. of Purchasing Agents, Annual Convention, (Oil Company Buyers' Group), Fairmont Hotel, San Francisco, Calif.

22-June 8—World Automotive Engineering Congress, sponsored by S.A.E. for New York (May 22-26), Indianapolis (May 30), Detroit (May 31-June 2), San Francisco (June 6-8).

Fruitvale To See Renewed Drilling

With Pacific Southwest Oil Co. Well No. 1 idle with poor oil sand showings at 3698 ft., in sec. 27,29-27, Fruitvale is temporarily inactive. There are, however, two projects scheduled for the drill. Meridian Oil Co. in sec. 23,29-27, has rig up for Fee No. 2, while Western Gulf Oil Co. plans a well to be know as KCL-Fruitvale No. 1. The rig is built on a location reported as 430 ft. south and 330 ft. east of the northwest corner of sec. 14,29-27.

Texas Company Suspends Santa Monica Wildcat

After a formation test to bottom of 7336 ft. failed to indicate productive possibilities, The Texas Co. suspended operations in its Anderson-Spring No. 1 at Santa Monica. The well was directionally redrilled and deepened when the original hole found the conglomerate zone barren.